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INSTALLATION RESTORATION PROGRAM

PHASE I - RECORDS SEARCH

McCONNELL AFB, KANSAS

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PREPARED FOR

UNITED STATES AIR FORCE
STRATEGIC AIR COMMAND

Deputy Chief of Staff
Engineering and Services
Offutt AFB, Nebraska 68113

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AUGUST 1985

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Alexandria, Virginia 22314

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AUGUST 1985

Prepared By

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57 Executive Park South, Suite 590
Atlanta, Georgia 30329

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EXECUTIVE SUMMARY

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material disposal sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Installation Assessment/Records Search; Phase II, Confirmation/Quantification; Phase III, Technology Base Development; and Phase IV, Operations/Remedial Actions. Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I, Initial Assessment/Records Search for McConnell Air Force Base (AFB) under Contract No. F08637-84-R0040.

INSTALLATION DESCRIPTION

McConnell AFB is located in south central Kansas on the southeast side of Wichita. The base is contained within the Wichita Metropolitan Statistical Area and is bordered by industry on the west and north, and by residential and agricultural lands on the east and south. The industrial facilities consist of Boeing Aircraft Company on the west, and Cessna Aircraft on the north.

The base comprises 3059 acres of U.S. government-owned and easement land. The remote installation facilities consist of the following:

- Titan II Missile Sites . . . . 4,500 acres
- Smoky Hill Weapons Range . . . . .33,873 acres

McConnell AFB became a permanent part of the Air Force in early 1952. It began in 1951 as the Wichita Air Force Base established at the existing commercial field sharing the flight line with the Community Airport and Boeing Aircraft Company. The base mission, with the Air Training Command (ATC) as the major command, was to serve as a training

base for the B-47 Stratojet bomber produced at Boeing's Wichita Plant. The base changed major commands several times. The ATC maintained command from 1951 to 1958, Strategic Air Command (SAC) from 1959 to 1963, Tactical Air Command (TAC) from 1963 to 1972 and finally SAC from 1972 to present. The 384th Air Refueling Wing (AREFW) assumes present host unit responsibilities.

Many of the base facilities were constructed between 1952 and 1955 during the initial build-up of the base. In 1961, the deployment of the Tital II Missle was begun and a number of launch sites constructed off-site.

ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation identified the following points relevant to McConnell AFB:

- The mean annual precipitation is 32.3 inches and net annual precipitation is calculated to be minus 25.7 inches. Smoky Hill Weapons Range annual precipitation is 28 inches, net annual precipitation is minus 28 inches.
- Localized flooding may be a problem at the base in the area adjacent to the Main Gate.
- No wetlands have been identified on the installation or the Smoky Hill Weapons Range.
- Base upland surface soils are predominantly silty or clayey and possess low permeabilities. They are underlain by low permeability shale bedrock. Soils present in the channels of base streams are silty sands and are somewhat more permeable. Extensive sand and gravel zones probably underlie the stream channel materials.
- Two aquifers of minor importance have been identified on base. A shallow aquifer, present at or near land surface, is composed of upland clayey sediments. A bedrock aquifer also underlies the base.
- Two aquifers are present at the Smoky Hill Weapons Range. An alluvial aquifer is present in the major stream valleys. The bedrock aquifer may be present at or near ground surface in most of the Range's upland areas.

- Shallow aquifer ground water was encountered at the base hospital at a depth of some five to fifteen feet below land surface. The depth to water in the deep (rock) aquifer is unknown. The depth to ground water in Range aquifers is unknown.
- The shallow aquifer (and probably the deep aquifer) receive recharge from precipitation or infiltration through streambeds within the base boundaries.
- All of the water-bearing zones identitied on base probably communicate hydraulically to some degree. During periods when area water levels are highest, the shallow aquifer likely discharges (provides base flow) to local streams.
- The shallow aquifer identified on base may be a source of water supplies to consumers located one mile east from McConnell AFB.
- Most study area consumers, both institutional and individual, obtain potable water supplies from the City of Wichita municipal system. The Wichita system obtains its water supplies from a surface source, Cheney Reservoir, located thirty miles northwest of the base and from the municipal well system located five to fifteen miles northwest of the installation in the Arkansas River alluvium. The municipal wells obtain ground water resources from an aquifer which does not underlie McConnell AFB.
- Historic water quality data indicates that base surface water generally conforms to the standard required for the designated use classifications of local streams.
- Unnamed tributaries of the Arkansas River on base are ephemeral streams; they contain moving water only when sufficient runoff is available to support flow.
- No threatened or endangered species have been identified on the base or on the Smoky Hill Range.

METHODOLOGY

During the course of this project, interviews were conducted with installation personnel (past and present) familiar with past waste disposal practices; file searches were performed for past hazardous waste activities; interviews were held with local, state and federal

agencies; and field surveys were conducted at suspected past hazardous waste activity sites. Twelve sites (Figure 1) were initially identified as potentially containing hazardous contaminants and having the potential for contaminant migration resulting from past activities. These sites have been assessed using a Hazard Assessment Rating Methodology (HARM) which takes into account factors such as site characteristics, waste characteristics, potential for contaminant migration and waste management practices. The details of the rating procedure are presented in Appendix G and the results of the assessment are given in Table 1. The rating system is designed to indicate the relative need for follow-up investigation.

FINDINGS AND CONCLUSIONS

The following conclusions have been developed based on the results of the project team field inspection, reviews of base records and files, interviews with base personnel, and evaluations using the HARM system.

The areas found to have sufficient potential to create environmental contamination are presented in Figure 1 and Table 1. Eleven other sites were reviewed and found not to have potential for contamination.

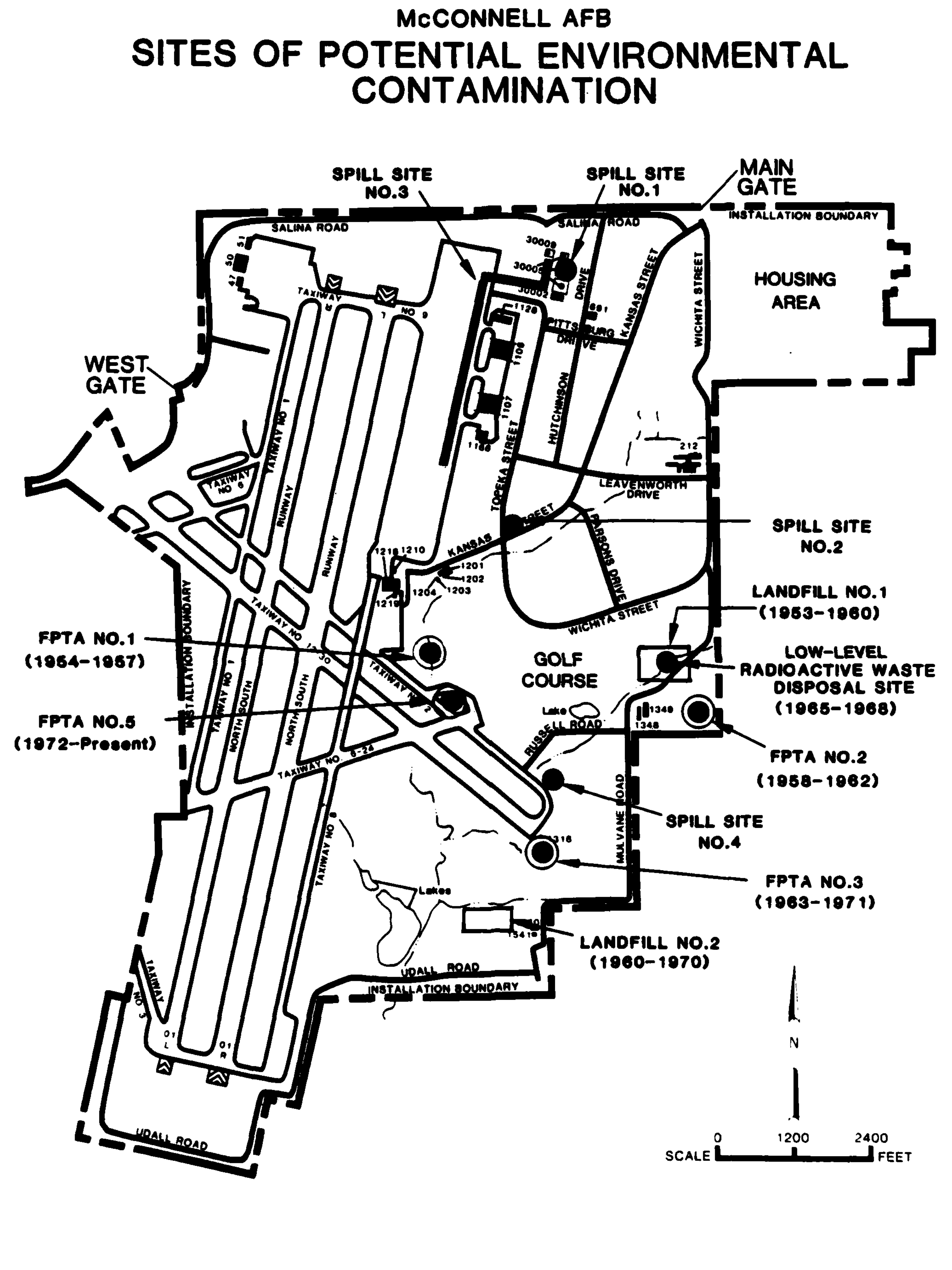
RECOMMENDATIONS

A program for proceeding with Phase II and other IRP activities at McConnell AFB is presented in Section 6. This program may be expanded to define the extent and type of contamination if the initial step reveals contamination. The Phase II recommendations are summarized as follows:

Site	Recommendations
Landfill No. 1	Conduct geophysical survey, install four ground-water monitoring wells, collect and analyze samples.

Site	Recommendations
Smoky Hill Weapons Range-Headquarters Disposal Site	Conduct geophysical survey of landfill area and install four ground-water monitoring wells, conduct soil borings to water table at three sites at drum drainage area, conduct soil borings to water table at two sites at MOGAS tank rupture site, collect and analyze samples.
Fire Protection Training Area No. 2	Conduct two soil borings to water table, collect and analyze samples.
Fire Protection Training Area No. 3	Conduct two soil borings to water table, collect and analyze samples.
Landfill No. 2	Conduct geophysical survey, install four ground-water monitoring wells, collect and analyze samples.
Spill site No. 3	Conduct geophysical survey if interferences are not severe, conduct soil borings to water table and analyze samples taken at 50-foot intervals along pipeline route or as indicated by the geophysical survey.
Fire Protection Training No. 1 and No. 5	Conduct two soil borings to water table, collect and analyze samples.
Spill Site No. 1	Conduct two soil borings to water table, collect and analyze samples.
Low-Level Radioactive Disposal Site	Monitor Landfill No. 1 wells for low-level radioactivity.
Spill Site No. 2	Conduct two soil borings to water table, install three ground-water monitoring wells, collect and analyze samples.
Missile Site No. 3-2	Conduct a single soil boring, install three ground-water monitoring wells, collect and analyze samples.
Spill Site No. 4	Collect shallow soil borings at three locations, collect and analyze samples.

FIGURE 1



SOURCE: INSTALLATION DOCUMENTS

TABLE 1
SITES EVALUATED USING THE
HAZARD ASSESSMENT RATING METHODOLOGY
MCCONNELL AFB

Rank	Site	Operation Period	HARM Score
1	Landfill No. 1	1953-1960	69
2	Smoky Hill Weapons Range Headquarters Disposal Site	1946-Present	64
3	Fire Protection Training Area No. 2	1958-1962	63
4	Fire Protection Training Area No. 3	1963-1971	61
5	Landfill No. 2	1960-1970	61
6	Spill Site No. 3	1954-1963	60
7	Fire Protection Training No. 1 & No. 5	1954-1957 No. 1 1972-Present No. 5	58
8	Spill Site No. 1	1982	57
9	Low-Level Radioactive Waste Disposal Area	1965-1968	54
10	Spill Site No. 2	1985	51
11	Missile Site 3-2	1983	50
12	Spill Site No. 4	1983	48

(1) This ranking was performed according to the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

SECTION 1

INTRODUCTION

BACKGROUND AND AUTHORITY

The United States Air Force, due to its primary mission of defense of the United States, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of past disposal sites and take action to eliminate hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of the Act, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and under Section 3012, state agencies are required to inventory past disposal sites, and Federal agencies are required to make the information available to the requesting agencies. To assure compliance with these hazardous waste regulations, the Department of Defense (DOD) developed the Installation Restoration Program (IRP). The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program. DOD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination, and to control hazards to health and welfare that resulted from these past operations. The IRP is the basis for response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, clarified by Executive Order 12316. CERCLA is the primary legislation governing remedial action at past hazardous waste disposal sites.

PURPOSE AND SCOPE

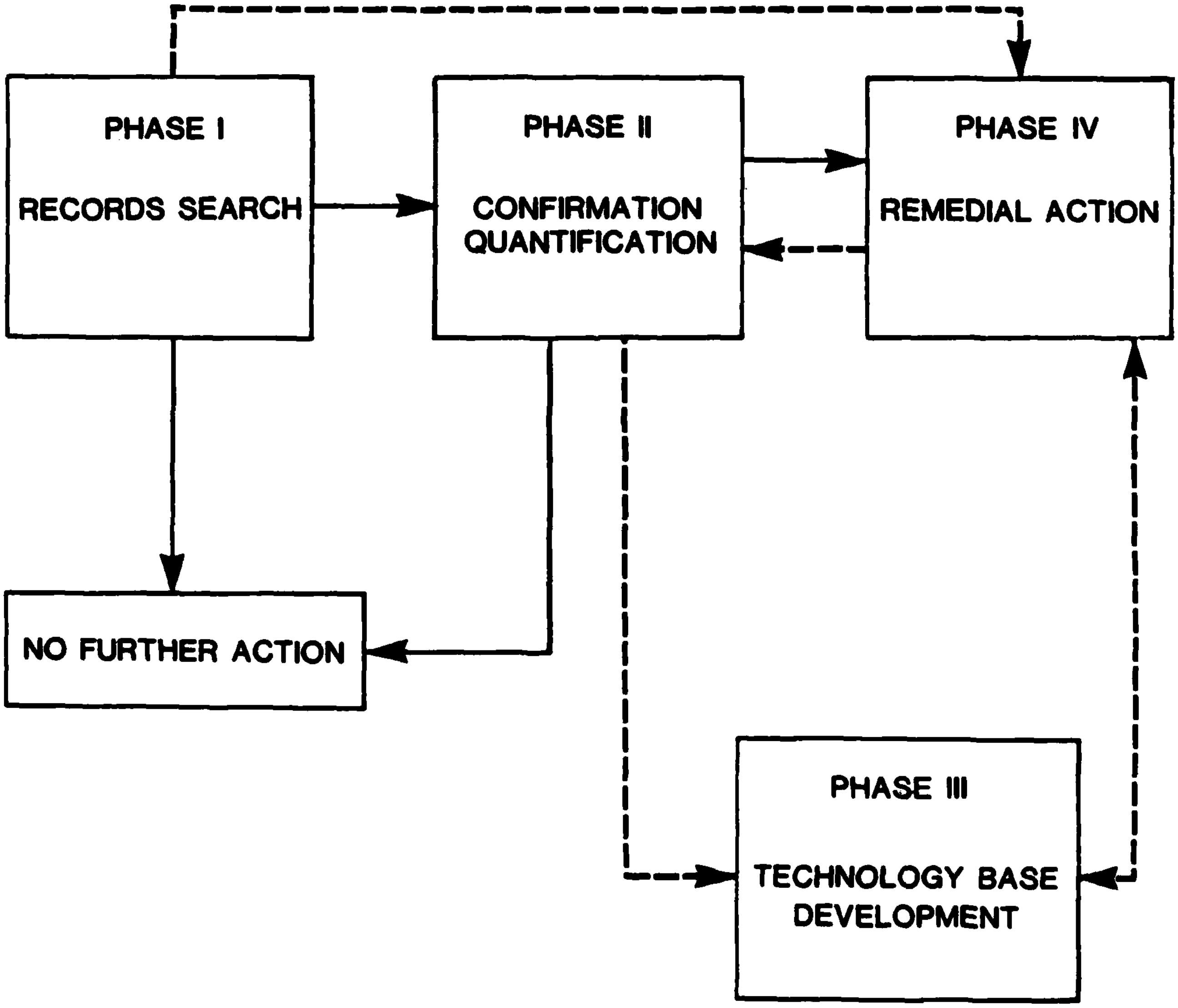
The Installation Restoration Program is a four-phased program (Figure 1.1) designed to assure that identification, confirmation/quantification, and remedial actions are performed in a timely and cost-effective manner. Each phase is briefly described below:

- Phase I - Installation Assessment/Records Search - Phase I is to identify and prioritize those past disposal sites that may pose a hazard to public health or the environment as a result of contaminant migration to surface or ground waters, or have an adverse effect by its persistence in the environment. In this phase it is determined whether a site requires further action to confirm an environmental hazard or whether it may be considered to present no hazard at this time. If a site requires immediate remedial action, such as removal of abandoned drums, the action can proceed directly to Phase IV. Phase I is a basic background document for the Phase II study.
- Phase II - Confirmation/Quantification - Phase II is to define and quantify, by preliminary and comprehensive environmental and/or ecological survey, the presence or absence of contamination, the extent of contamination, waste characterization (when required by the regulatory agency), and to identify sites or locations where remedial action is required in Phase IV. Research requirements identified during this phase will be included in the Phase III effort of the program.
- Phase III - Technology Base Development - Phase III is to develop a sound data base upon which to prepare a comprehensive remedial action plan. This phase includes implementation of research requirements and technology for objective assessment of adverse effects. A Phase III requirement can be identified at any time during the program.
- Phase IV - Operations/Remedial Actions - Phase IV includes the preparation and implementation of the remedial action plan.

Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I Records Search at McConnell AFB under

FIGURE 1.1

U.S. AIR FORCE INSTALLATION RESTORATION PROGRAM



SOURCE: AFESC

Contract No. F0863784R0040. This report contains a summary and an evaluation of the information collected during Phase I of the IRP and recommended follow-on actions. The approximate land area included as part of the McConnell AFB study is as follows:

- o Main Base Site - 3,059 acres
- o Titan II ICBM Missile Sites (18 sites) - 4,500 acres
- o Smoky Hill Weapons Range - 33,873 acres

The activities performed as a part of the Phase I study scope included the following:

- Review of site records
- Interviews with personnel familiar with past generation and disposal activities
- Survey of types and quantities of wastes generated
- Determination of current and past hazardous waste treatment, storage, and disposal activities
- Description of the environmental setting at the base
- Review of past disposal practices and methods
- Reconnaissance of field conditions
- Collection of pertinent information from federal, state and local agencies
- Assessment of the potential for contaminant migration
- Development of recommendations for follow-on actions

ES performed the on-site portion of the records search during April 1984. The following team of professionals were involved:

- E. J. Schroeder, P.E., Environmental Engineer and Project Manager, 17 years of professional experience.
- J. R., Absalon, C.P.G., Hydrogeologist, 12 years of professional experience.

- R.D. Stephens, Environmental Scientist, 14 years of professional experience.
- R. W. O'Brien, Chemical Engineer, 5 years of professional experience.
- J. R. Butner, Environmental Scientist, 5 years of professional experience.

More detailed information on these five individuals is presented in Appendix A.

METHODOLOGY

The methodology utilized in the McConnell AFB Records Search began with a review of past and present industrial operations conducted at the installation. Information was obtained from available records such as shop files and real property files, as well as interviews with almost 100 past and present base employees from various operating areas. Those interviewed included current and past personnel associated with civil engineering, fuels management, roads and grounds maintenance, fire protection, real property, history, shop operations, Kansas National Guard, and Local citizens with knowledge of previous uses of current base property. A listing of interviewee positions with approximate years of service is presented in Appendix B.

Concurrent with the employee interviews, the applicable federal, state and local agencies were contacted for pertinent study area related environmental data. The agencies contacted are listed below and in Appendix B.

- U.S. Geological Survey, Water Resources Division, Lawrence, KS
- Kansas Department and Health and Environment
- Sedgwick County Environmental Resources Dept., Air Quality Control
- Office of Air Force History (Wasington, DC)
- Washington National Record Center (Suitland, MD)
- National Archives (Washington, DC and Alexandria, VA)

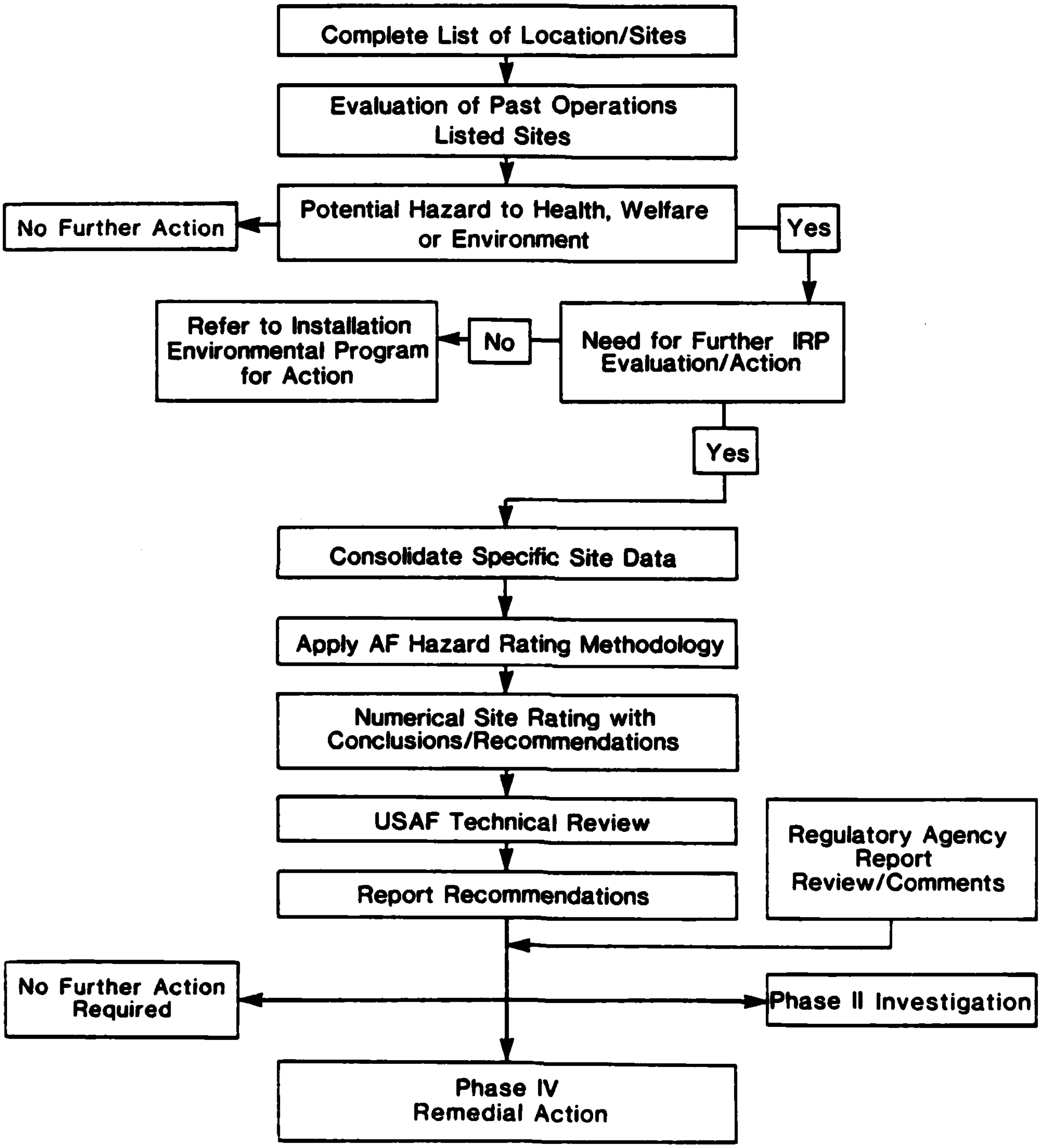
The next step in the activity review was to identify all sources of hazardous waste generation and to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various sources on the base. Included in this part of the activities review was the identification of all known past disposal sites and other possible sources of contamination such as spill areas.

A general ground tour and an overflight of the identified sites were made by the ES Project Team to gather site-specific information including: (1) general observations of existing site conditions; (2) visual evidence of environmental stress; (3) presence of nearby drainage ditches or surface waters; and (4) visual inspection of these water bodies for any obvious signs of contamination or leachate migration.

A decision was then made, based on all of the above information, whether a potential hazard to health, welfare or the environment exists at any of the identified sites using the Flow Chart shown in Figure 1.2. If no potential existed, the site received no further action. For those sites where a potential hazard was identified, a determination of the need for IRP evaluation/action was made by considering site-specific conditions. If no further IRP evaluation was determined necessary, then the site was referred to the installation environmental program for appropriate action. If a site warranted further investigation, it was evaluated and rated using the Hazard Assessment Rating Methodology (HARM). The HARM score is a resource management tool which indicates the relative potential for adverse effects on health or the environment at each site evaluated.

PHASE I INSTALLATION RESTORATION PROGRAM

RECORDS SEARCH FLOW CHART



Source: AFESC

SECTION 2

INSTALLATION DESCRIPTION

LOCATION, SIZE AND BOUNDARIES

McConnell AFB is located in south central Kansas on the southeast side of Wichita. The base is contained within the Wichita Metropolitan Statistical Area and is bordered by industry on the west and north, and by residental and agricultural lands on the east and south (see Figure 2.1 and 2.2). The industrial facilities consist of Boeing Aircraft Company on the east, and Cessna Aircraft on the north.

The main base site comprises approximately 3,059 acres (see Figure 2.3) of U.S. government-owned and easement land. Remote installation facilities consist of the following:

- Titan II Missile Sites (eighteen total) . . . . 4,500 acres
- Smoky Hill Weapons Range. . . . . 33,878 acres

The 18 Titan II missile sites are located in remote areas to the east and west of McConnell AFB as shown on Figure 2.2. Each complex consists of a 9 acre, fee owned tract of land for the basic operational functions and about 3 acres of fee owned land for antennas and helicopter pads. Each site has a restrictive easement 1,800 feet (approximately 225 acres) in radius as measured from the launch complex.

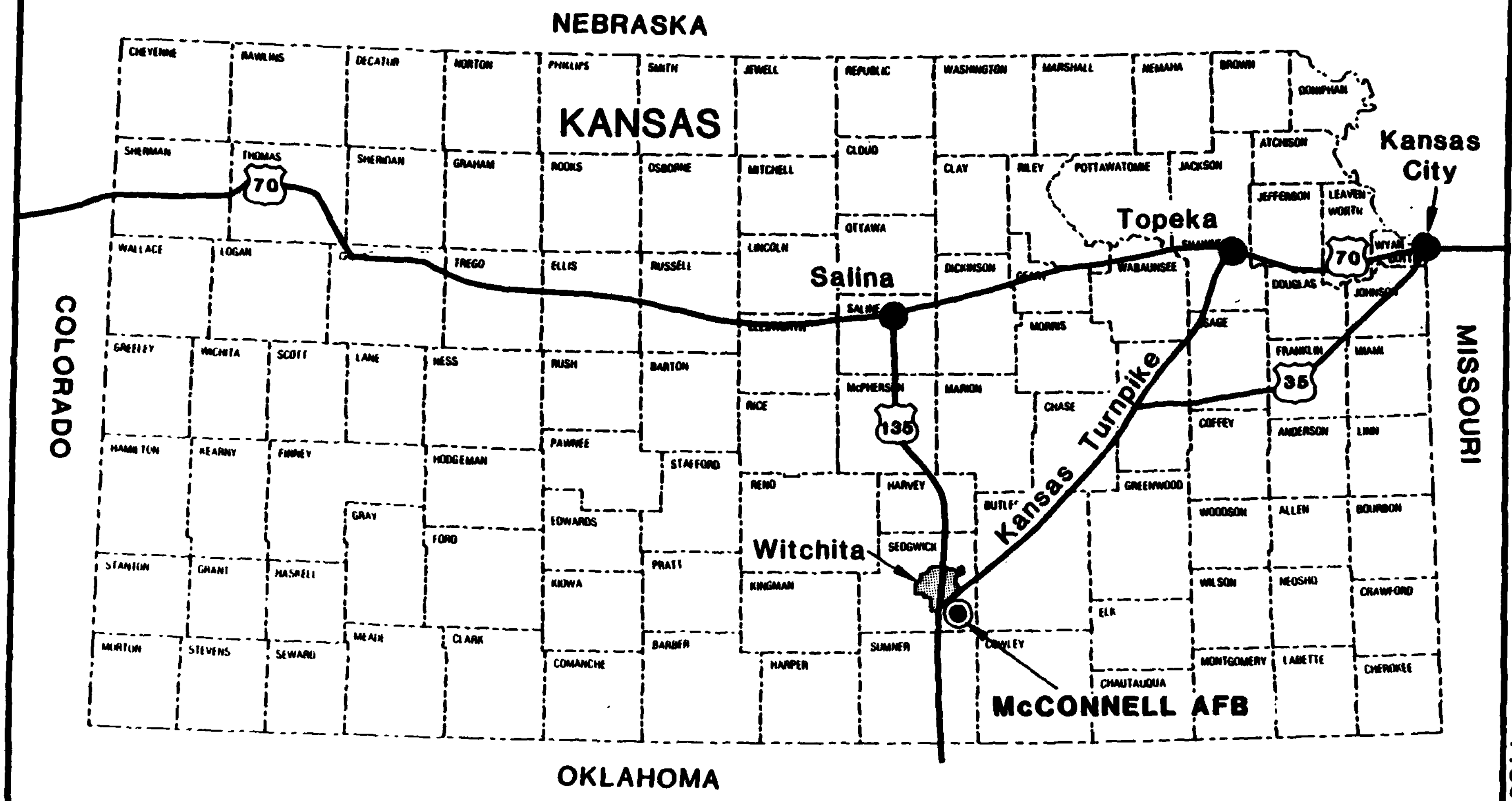
Smoky Hill Weapons Range was acquired by the Air Force in 1952 and is located approximately 80 miles northwest of the base in a rural area southeast of the town of Salina, Kansas (see Figure 2.4). This is an active bombing range operated by the Kansas Air National Guard.

BASE HISTORY

The land area which the base currently occupies was originally used as the commercial airfield serving the Wichita area. Use of the land as a commercial field dates back to 1924.

FIGURE 2.1

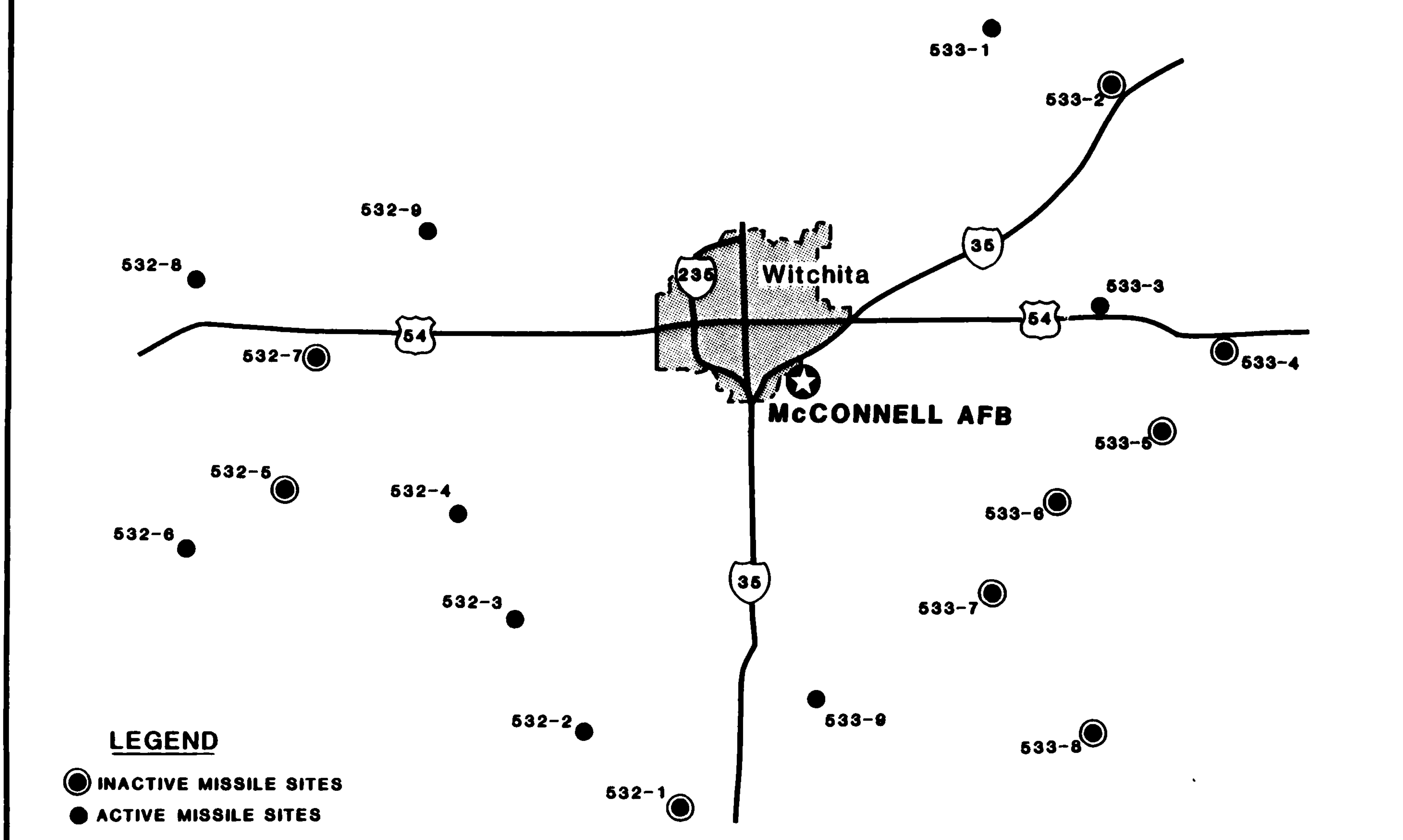
McCONNELL AFB
REGIONAL LOCATION MAP



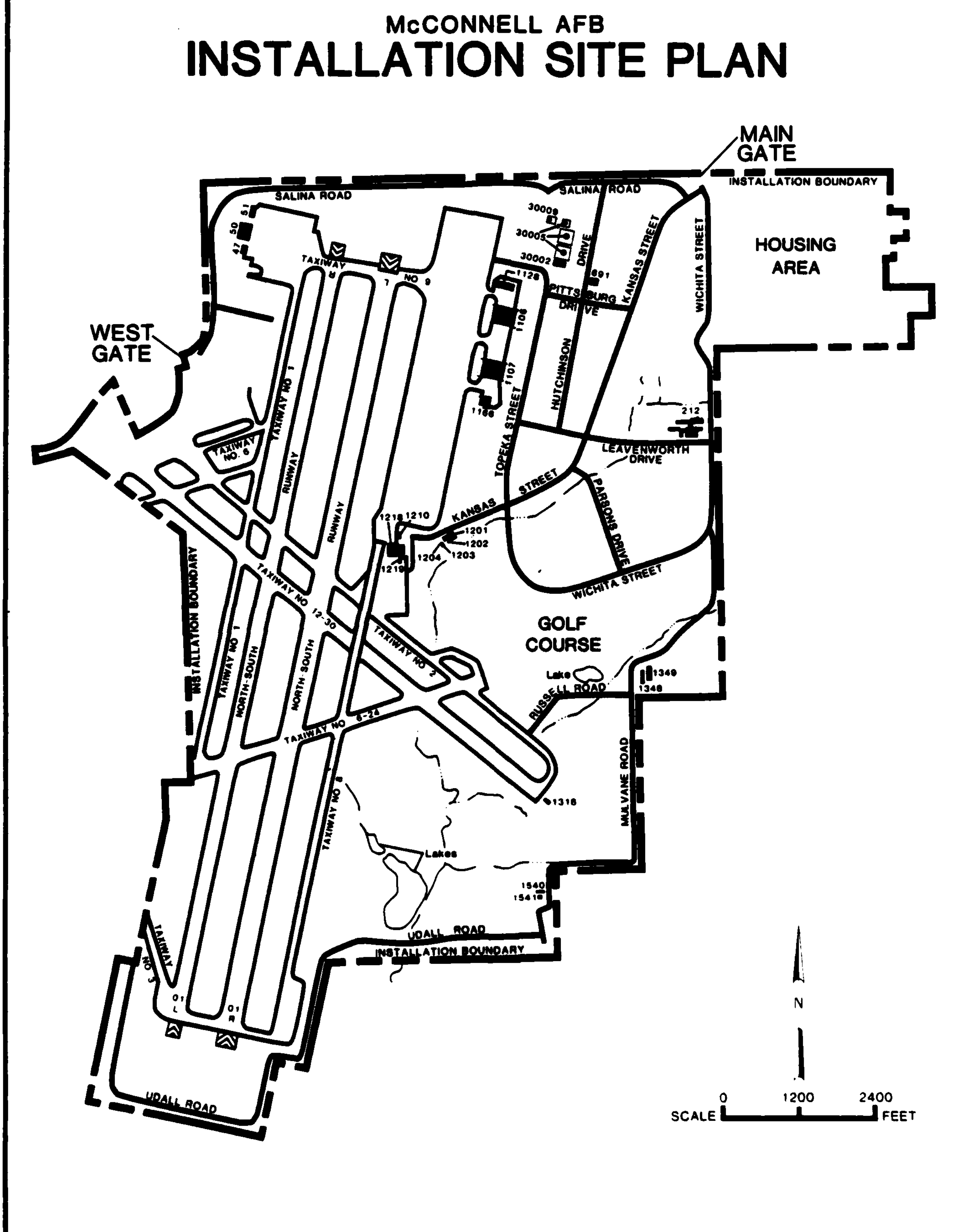
SOURCE: COMMERCIAL ROAD ATLAS

McCONNELL AFB

AREA LOCATION MAP



SOURCE: INSTALLATION DOCUMENTS



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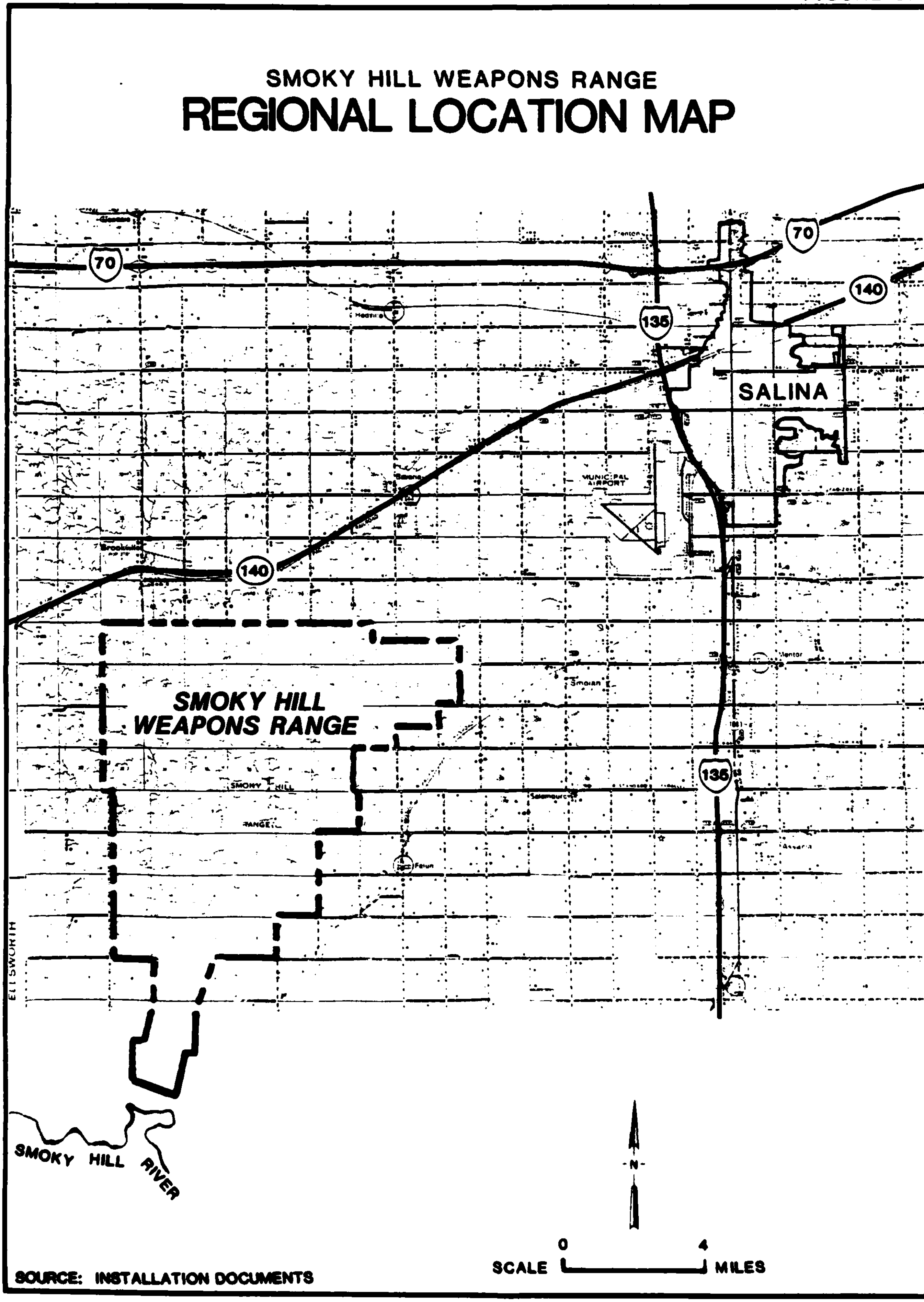

SMOKY HILL WEAPONS RANGE
REGIONAL LOCATION MAP
70
135
140
SALINA
MUNICIPAL AIRPORT
SMOKY HILL
WEAPONS RANGE
SMOKY HILL RANGE
ELLSWORTH
SMOKY HILL RIVER
N
SCALE 0 4 MILES
SOURCE: INSTALLATION DOCUMENTS

The eastern portion of the base, where shops and administration offices are now located previously consisted of open farm and pasture land.

McConnell AFB became a permanent part of the Air Force System in early 1952. It began on a temporary basis in 1951 as the Wichita Air Force Base which was established at the existing commercial field. The base was made a permanent installation when the government acquired the airport at Wichita in 1952. A training command was established for B-47 and B-45 bombers which were being produced at the neighboring Boeing Plant. This initial training mission was expanded almost immediately to include a combat training role under the Air Training Command (ATC). In 1952, a major construction program was begun and many of the current buildings were erected and runways were expanded. For a brief period from 1959 to 1963, SAC was designated the host unit.

In the early 1960's McConnell AFB was selected to host the Titan II Intercontinental Ballistic Missile. Construction began on the first missile complex in January of 1961. The 381st Strategic Missile Wing was activated at that time to maintain and operate the missiles. Full operational status was achieved in 1963 when all Titan II missiles were placed in the silos.

The Air Force officially transferred McConnell AFB from SAC to Tactical Air Command (TAC) in July 1963 and the 388th Tactical Fighter Wing became the new host unit. The fighters were transferred to the Air National Guard in July 1972 and McConnell AFB host responsibilities were reassigned from TAC to SAC and the 381st Strategic Missile Wing (381st SMW) was assigned host responsibilities. The 381st SMW has retained that position until June 1985 at which time the host unit was changed to the 384th Air Refueling Wing (AREFW). Despite the changes in command, many shops continued to perform their daily operations with a minimum amount of change.

The Kansas Air National Guard moved to McConnell AFB at the same time the base was activated in the early 1950's and has maintained a presence at McConnell AFB since then. The unit has flown propeller and jet fighter aircraft, including F-4 aircraft which it currently operates out of McConnell AFB.

ORGANIZATION AND MISSION

The host unit at McConnell AFB is the 384th Air Refueling Wing (AREFW). The primary mission of the 384th Air Refueling Wing is to be prepared to rendezvous and refuel airborne aircraft anytime, day or night, when the need exists. The 384th maintains a constant alert commitment to support Strategic Air command B-52 operations in the event of general war.

In February of 1984, the Air Force announced that the 381st SMW, the former host unit at McConnell AFB, would be deactivated starting in the summer of 1984. As a result, the 381st SMW now has a dual mission - to sustain the capability to conduct strategic warfare, and concurrently to deactivate the missiles one at a time. Nine of the 18 missile sites have been deactivated to date.

There are several base organizations on base that have missions of importance to this report because they are involved with the accumulation, treatment, or disposal of hazardous waste at McConnell AFB. These organizations include the Civil Engineering (CE) Squadron of the 384th Combat Support Group, the 384th Field Maintenance Squadron, the 384th Operations Maintenance Squadron, the 384th Avionics Maintenance Squadron, the 384th Supply Squadron and the 384th Transportation Squadron of the 384th AREFW, the 381st SMW and the 184th Tactical Fighter Group.

The tenant organizations at McConnell AFB are listed along with descriptions of their missions in Appendix C.

SECTION 3
ENVIRONMENTAL SETTING

The environmental setting of McConnell Air Force Base is described in this section with the primary emphasis directed toward the identification of features or conditions that may facilitate the generation and migration of hazardous waste-related contamination. Environmentally sensitive conditions pertinent to this study are summarized at the end of the section.

CLIMATE

Temperature, precipitation, snowfall and other relevant climatic data furnished by Detachment 23, 26th Weather Squadron, McConnell AFB, Kansas, are listed on Table 3.1. The period of record is twenty-eight years. The summarized data indicate that mean annual precipitation for McConnell AFB is 32.3 inches. The net annual precipitation for McConnell AFB is calculated to be minus 25.7 inches, based on National Oceanographic and Atmospheric Administration information (NOAA, 1983). Net precipitation is equal to total precipitation minus evaporation. The net annual precipitation is one of several factors used to estimate the amount of meteoric water potentially available for infiltration into the subsurface and does not consider evapotranspiration, which varies seasonally, or surface conditions, which may differ locally. The infiltration potential for McConnell AFB is considered to be minimal. The one-year, twenty-four hour rainfall value for the study area is 2.75 inches, which has been interpolated from charts published by the US Department of Commerce, Weather Bureau (1961). This value suggests that a moderate potential for the development of erosion exists. No evidence of erosional impacts were observed during on-site inspections. The soils at the base are clayey and are moderately susceptible to erosion.

The study area is located in a subhumid climatic region of the central United States. The summers are warm with low to moderate humidity; the winters are relatively mild with brief cold periods. The

TABLE 3.1
CLIMATOLOGICAL DATA

MONTH	Temperature (°F)					Precipitation (In)				Snowfall (In)			Surface Winds	
	Mean			Extreme		Monthly			Max	Monthly		Max	Prevailing	Mean
	Daily		Monthly											
	Max	Min		Max	Min	Mean	Max	Min	24 Hrs	Mean	Max	24 Hrs	Direction	Speed (kt)
JAN	39	21	30	74	-11	.9	3.1	.1	1.3	4	14	7	N	8
FEB	46	26	36	84	-5	1.0	2.8	#	1.6	4	19	9	N	9
MAR	55	34	45	88	0	2.3	10.6	#	2.4	3	18	15	S	10
APR	68	47	58	97	17	3.1	7.2	.4	3.3	#	4	4	S	10
MAY	76	56	66	100	32	4.3	9.0	.5	2.7	0	0	0	S	8
JUN	86	65	76	108	48	4.0	10.1	.6	5.1	0	0	0	S	8
JUL	92	71	82	114	52	4.0	9.1	#	4.3	0	0	0	S	8
AUG	91	69	80	110	52	3.3	10.5	.4	6.9	0	0	0	S	8
SEP	81	61	71	104	37	3.7	9.3	.2	3.4	0	0	0	S	7
OCT	71	49	60	96	21	2.9	9.7	#	4.4	#	1	1	S	8
NOV	55	36	45	82	6	1.7	7.8	0	2.8	1	8	5	S	9
DEC	44	26	36	81	-3	1.1	2.6	#	2.2	3	8	5	N	8
ANN	67	47	57	114	-11	32.3	10.6	.0	6.9	15	19	15	S	8
EYR	28	28	28	28	28	28	28	28	28	28	28	28	10	10

Source: Detachment 23, 26th Weather Squadron, McConnell AFB, Kansas.

Period of Record: 1953 - 1981

= Indicates trace amounts

EYR = Years of Record

warmest months are May to September; the coldest include December through March. Precipitation occurs primarily during the spring and summer growing season months as brief, heavy thunderstorms. Rainfall occurrence during the remainder of the year is infrequent when compared to spring. Surface wind directions favor the north during the winter months of December though February and the south during the months of March through November. It is this windflow pattern that is largely responsible for the precipitation distribution pattern. The southerly flow of air during the spring and summer months allows cool polar air to mix with moist air from the Gulf of Mexico, resulting in the sporadic precipitation common to the study area during the growing season.

The climate of the Smoky Hill Weapons Range is similar to that experienced by McConnell AFB. The annual precipitation averages 28 inches. The calculated annual net precipitation value is minus 28 inches. The infiltration potential for Smoky Hill Weapons Range is considered to be minimal. The one-year, twenty-four hour rainfall values for the Range is 2.5 inches, which has been interpolated from charts published by the US Department of Commerce, Weather Bureau (1961). This value suggests that a moderate potential for the development of erosion exists. The soils present at the reservation are loamy and are moderately susceptible to erosion.

GEOGRAPHY

The McConnell AFB study area lies within the Arkansas River Lowlands subdivision of the Central Lowlands Physiographic Province. The Arkansas River Lowlands form a narrow east and southward trending feature characterized by the prominent Arkansas River floodplain bordered by gently sloping valley walls. The area is characterized by nearly level areas, gently rolling hills and broad flat plains which offer little spatial variation. Major streams are well entrenched. The channels of secondary streams may exhibit a sag and swale appearance, indicative of the erosion of cohesive native soils.

The Smoky Hill Weapons Range is located within the Smoky Hills of the Dissected High Plains subdivision of the Great Plains Physiographic Province. The Smoky Hills are characterized by gently to steeply rolling hills. Prominent ridge lines are narrow, well defined stream

channels occurring in closely spaced subparallel valleys. The valleys of local streams and secondary drainage features appear to be V-shaped when viewed in cross-section; this is indicative of the erosion of mostly granular native soils.

Study area physiographic divisions are illustrated on Figure 3.1.

Topography

The topography of Wichita and the surrounding area varies from generally level to gently rolling in appearance. Local relief is primarily the result of dissection by erosional activity, stream channel development, or site use modifications. At Wichita, ground surface elevations average 1,300 feet, National Geodetic Vertical Data of 1929 (NGVD). At McConnell Air Force Base, surface elevations vary from 1,310 feet, NGVD at the culvert under Udall Road, south of Runway 01 Left, to 1,380 feet, NGVD at the US Geological Survey benchmark located 160 feet southwest of Building 37. Installation relief is seldom more than ten feet and is most conspicuous along the shore of the base lake.

The elevation of ground surface at the Smoky Hill Weapons Range varies from a low of 1,300 feet, NGVD along the course of Ralston Creek at the north installation boundary (northeast corner of Section 18, Township 15 South, Range 4 West) to a high of 1,625 feet, NGVD at the US Geological Survey benchmark located at the peak of Loder Hill (southeast corner of Section 21, Township 16 South, Range 5 West). The maximum relief apparent at the Smoky Hill facility is on the order of ninety feet, occuring in the vicinity of Loder Hill.

Drainage

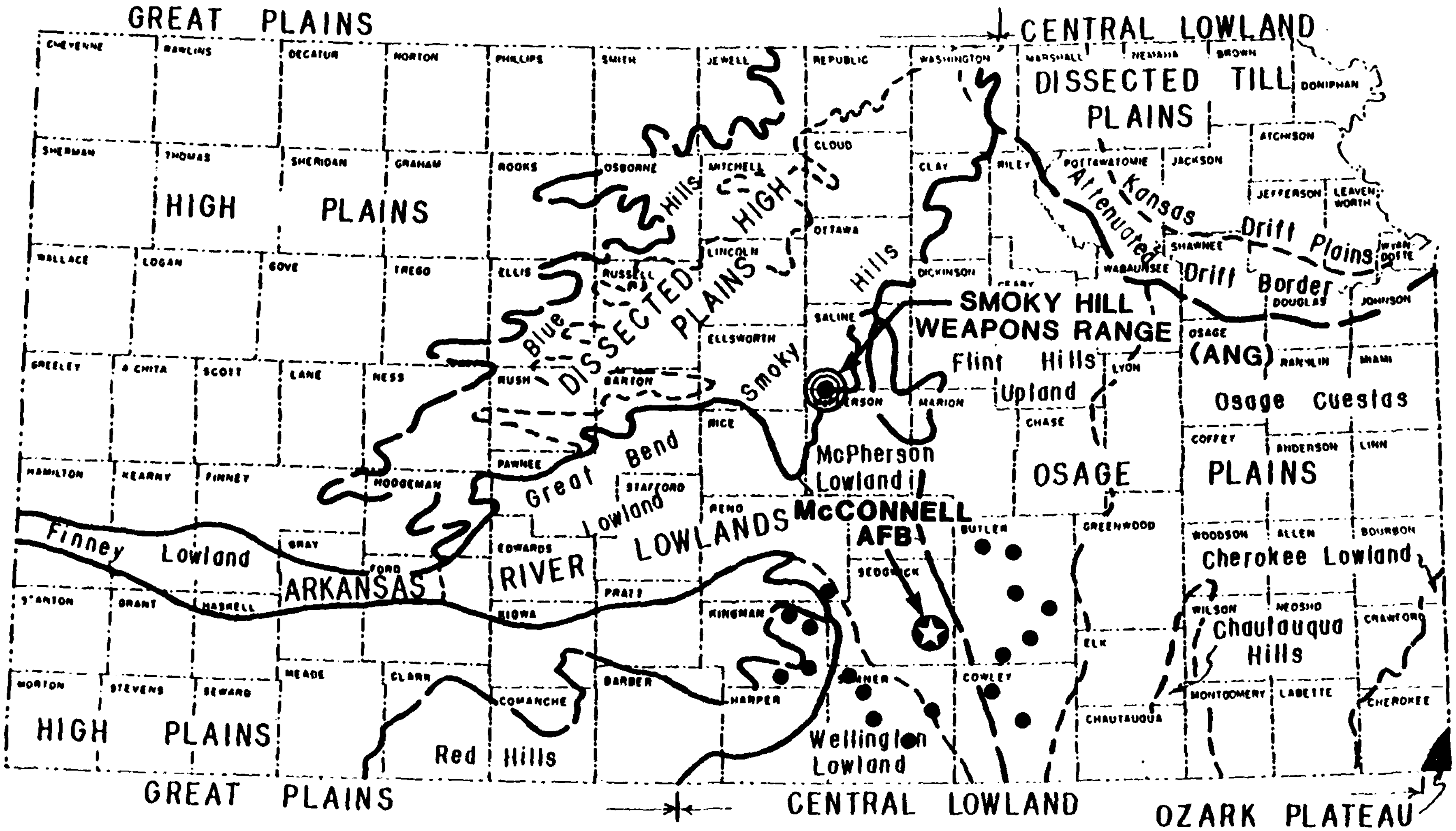
The drainage of McConnell Air Force Base land areas is accomplished by overland flow of runoff to diversion structures and thence to area surface streams, which flow intermittently. Most installation drainage is directed south to an unnamed tributary of the Arkansas River. The tributary is ephemeral and only contains water when sufficient runoff is available to enable flow. The base is located in the Arkansas River drainage basin.

Flooding may occur on base in the vicinity of the main gate during periods of intense precipitation. The level nature of the installation land surface and drainage structures tend to restrict runoff so that temporarily impounded flood waters are permitted to dissipate before

FIGURE 3.1

McCONNELL AFB

STUDY AREA PHYSIOGRAPHIC DIVISIONS



SOURCE: LANE AND MILLER, 1965

● MISSILE SITE LOCATION

significant accumulation is allowed to occur. The small area susceptible to temporary flooding would not be expected to impact either the base mission or past hazardous waste management facilities. No wetland areas have been identified on base. McConnell AFB drainage features are illustrated on Figure 3.2.

The drainage of land areas within the Smoky Hill Weapons Range is accomplished by overland flow to local surface streams. All streams on the Range are ephemeral and contain water only when sufficient runoff is available to support flow. Runoff originating from the north and west section of the Range is directed to Ralston Creek and Spring Creek. Drainage originating on the east section of the range is directed to West Dry Creek or its unnamed tributaries. Runoff developing on the extreme southern portion of the Range is directed to unnamed tributaries of the Smoky Hill River. The unnamed tributaries are ephemeral; the major streams flow continuously. The Smoky Hill Weapons Range is located in the drainage basin of the Missouri River.

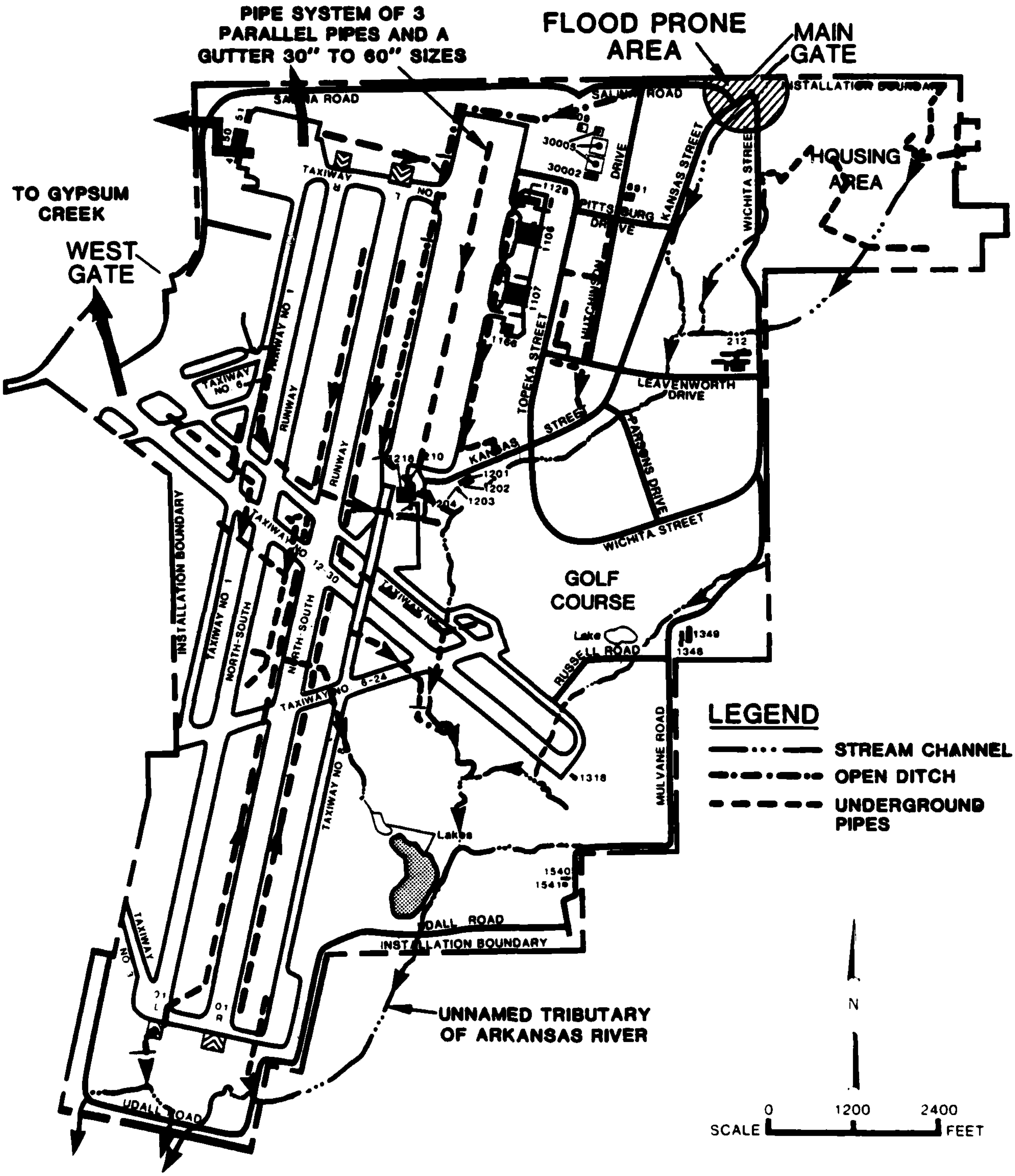
Flooding is not known to be a problem at the Range. However, it is possible that localized flash flooding could develop in narrow stream valleys during periods of intense precipitation. No wetlands exist on the range. The drainage features of the Smoky Hill Weapons Range are illustrated on Figure 3.3.

Surface Soils

The surface soils of the McConnell Air Force Base study area have been mapped by the USDA, Soil Conservation Service (1979). Nine soil types and one undefined unit, "Dumps and other non-soil areas" have been identified on the installation. The principle characteristics of these ten soil units relative to this study are summarized on Table 3.2. The distribution of the base soils is illustrated on Figure 3.4.

The modern soils of McConnell AFB have developed primarily in calcareous alluvium, colluvium (or other clayey sediment) and loess (wind-blown silt). One unit, the Rosehill silty clay (Rd), has formed in residuum (a soil formed by the weathering of bedrock which retains the relict structural appearance of the rock). Most of the modern soils present on base are clayey in the upper extent of their profiles, are plastic and tend to possess low permeabilities. The Milan loam (Ma),

McCONNELL AFB
INSTALLATION DRAINAGE



SOURCE: GRW ENGINEERS, INC., 1985 AND INSTALLATION DOCUMENTS

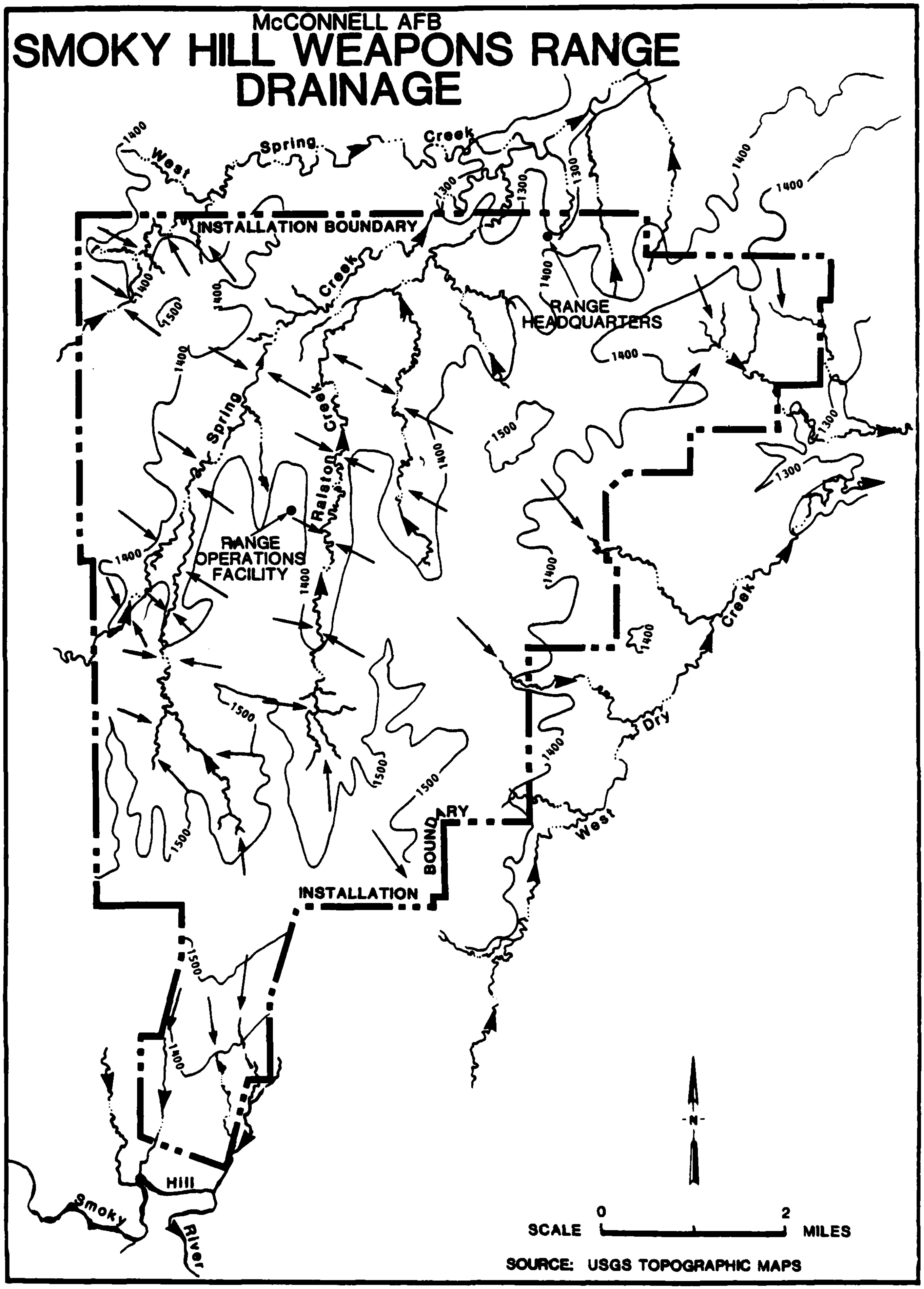
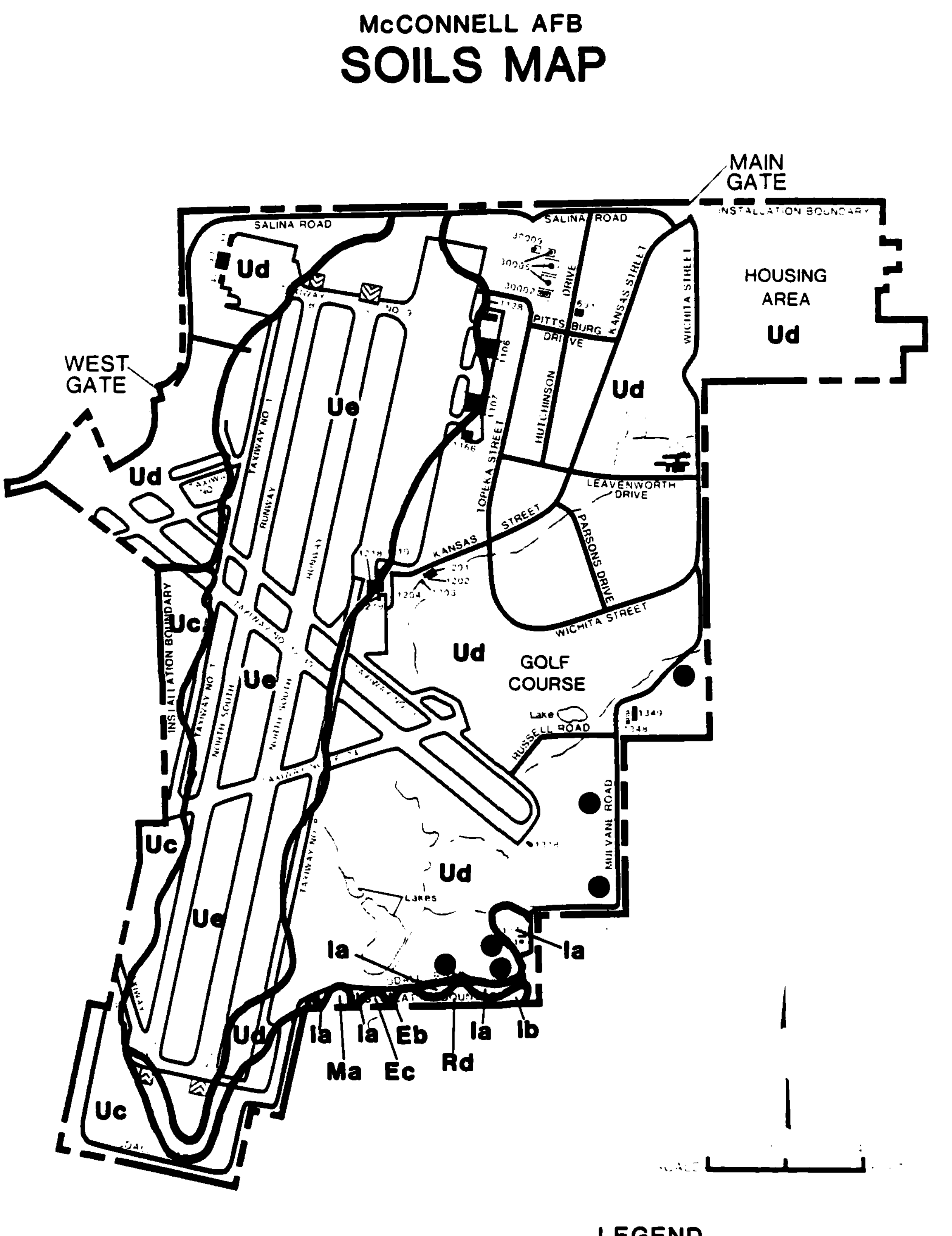

McCONNELL AFB
SMOKY HILL WEAPONS RANGE
DRAINAGE
West Spring Creek
INSTALLATION BOUNDARY
Spring Creek
Ralston Creek
RANGE HEADQUARTERS
RANGE OPERATIONS FACILITY
Dry Creek
West
INSTALLATION BOUNDARY
Smoky Hill River
1300
1400
1500
N
SCALE 0 2 MILES
SOURCE: USGS TOPOGRAPHIC MAPS

TABLE 3.2
MCCONNELL AIR FORCE BASE SOILS

Map Symbol (Figure 3.3)	Unit Description (Major Fraction)	USDA Texture (Major Fraction)	Thickness (Inches)	Unified Classification** (Major Fraction)	Permeability (Inches/Hours)	Parent Material (Major Fraction)	Disposal Facility Potential Development Contraints
Eb	Elandco silt loam, occasionally flooded.	Silt loam, silty clay loam, clay loam.	60	CL, ML	0.6 - 2.0	Alluvium	Severe. Subject to flooding.
Ec	Elandco silt loam, frequently flooded.	Silt loam, silty clay loam, clay loam.	60	CL, ML	0.6 - 2.0	Alluvium	Severe. Subject to flooding.
Ia	Irwin silty clay loam, 1-3% slopes.	Silty clay loam, silty clay, clay.	60	CL, CH	<0.06 - 2.0	Colluvium	None.
Ib	Irwin silty clay loam, 3-6% slopes.	Silty clay loam, silty clay, clay.	60	CL, CH	<0.06 - 2.0	Colluvium	None.
[illegible]	Milan loam, 1-3% slopes.	Loam, clay loam, sandy clay loam.	60	CL, CH, SC	0.2 - 2.0	Loess	Moderate Permeability.
[illegible]	Rosehill silty clay, 1-3% slopes.	Silty clay, clay, bedrock.	30	CL, CH	<0.06	Residuum	Severe. Bed-rock depth forty inches or less.
[illegible]	Urban land-Farnum complex.	Loam, clay loam, sandy clay loam, sandy loam, loamy sand, sand.	60	CL, SC, SM, ML, SP-SM	0.2 - 2.0	Alluvium	Severe Permeability.
[illegible]	Urban land-Irwin complex.	Silty clay loam, silty clay, clay.	60	CL, CH	<0.06 - 2.0	Colluvium	None.
[illegible]	Urban land-Tabler complex.	Silty clay loam, silty clay, clay.	60	CL, CH, ML	<0.06 - 0.6	Colluvium	Severe. Perched seasoned water table, 30 to 42 inches below land surface.
[illegible]	*Dumps and other non-soil areas	Properties not estimated	-	-	Varies	Unknown	Unknown.

Source: Modified from USDA, SCS, 1977
Notes: * The properties of this unit are highly variable.
** Unified system classification (ASTM D-2487-69): ML: low plasticity silt; CL: low plasticity clay; CH: high plasticity clay, SC: clayey sand; SM: silty sand; SP-SM: poorly graded silty sand.

[illegible]



SOURCE: USDA, SCS, 1979
BASED ON AERIAL IMAGERY DATED 1975

ES ENGINEERING-SCIENCE

formed in loess, has a silty texture and moderate permeability. The Urban Land-Farnum Complex (Uc) has a sandy layer in the lower extent of its profile which gives the unit moderate to high permeabilities.

Five of the soil units mapped on the installation place severe constraints on disposal facilities due to flooding, shallow bedrock, permeability or the presence of a high seasonal (probably perched) water table. The properties of one unit, dumps and other non-soil areas (D), have not been estimated. The soils present in this area have been removed, buried or altered as a result of extensive site use modifications. The aerial imagery used by the Soil Conservation Service to plot the distribution of county soil units, was dated 1975, and therefore reflects base conditions as of that date.

The soils present on the Smoky Hill Weapons Range have been mapped by the USDA, Soil Conservation Service (1959 and 1983) and have been discussed in detail by Olson (1974). Three major soil associations have been identified on the Range. These include the Hedville, Lancaster and Smolan Soil Associations.

The Hedville Association has formed in residual upland soils and occurs on hills and ridges. This association is a shallow stony loam developed from the underlying interbedded sandstones and sandy shales of the Dakota Formation. The association is well to excessively well drained and has a high permeability. It is susceptible to erosion. Its typical profile is ten or more inches thick.

The Lancaster Association commonly occurs on the slopes adjacent to hills and ridges. This association is also a residual soil and is composed of loam, clay loam and sandy clay loam. It is well drained; its permeability is described as moderately high. It is moderately susceptible to erosion. Its typical profile is 66 inches thick.

The Smolan Association occupies the lower topographic positions in the Range area. The unit has developed in moderately fine-textured loess and alluvium. Its profile is typically 72 inches thick and consists of silty clay loam, silty clay and silt loam. This soil unit is well drained and has a low permeability. Due to its low topographic position on the landscape, this soil unit may be susceptible to flooding and possess a seasonally high water table.

GEOLOGY

Information describing the geology of the McConnell Air Force Base and the Smoky Hill Weapons Range study areas has been reported by Williams and Lohman, 1949; Petri, et al., 1964; Kansas Geological Survey, 1964 and 1983b; Lane and Miller, 1965. Additional information has been obtained from an interview with a US Geological Survey scientist. A brief overview of the available information with pertinent comments is included in the following discussion.

Regional Geology

Geologic units ranging in age from Permian to Neogene have been identified as significant to subsurface investigations in the McConnell AFB study area. These units consist of unconsolidated loess and/or loess mixed with colluvium composed of clay, silt, sand with minor amounts of gravel. Residual soil is present as a thin veneer overlying bedrock in some upland areas. The regional bedrock unit is the Permian Series Wellington Formation. The Wellington is primarily a gray and blue shale, with thin limestone, gypsum and anhydrite beds occuring locally. Thick salt deposits occur deep within the Wellington and are identified as the Hutchinson Salt Member. Table 3.3 summarizes the major geologic units present in the McConnell AFB area and describes their significant characteristics, in chronological order.

Geologic units ranging in age from Permian to Neogene have been identified in the Smoky Hill Weapons Range study area. These units consist of unconsolidated alluvium present in stream valleys which includes sand, gravel, silt and clay and consolidated rocks composed of sandstone, siltstone, shale and gypsum. Table 3.4 summarizes the principle geologic units occuring at the Smoky Hill Weapons Range.

Distribution and Structure

The surface distribution of major geologic units mapped at McConnell Air Force Base is shown on Figure 3.5, which is modified from Petri, et al. (1964) and Lane and Miller (1965). Generally the geology of McConnell AFB is dominated by two principle units: Neogene unconsolidated materials and Permian bedrock. The unconsolidated materials mantle the bedrock and include two generalized types:

TABLE 3.3
GENERALIZED SECTION OF GEOLOGIC FORMATIONS IN SEDGWICK COUNTY, KANSAS

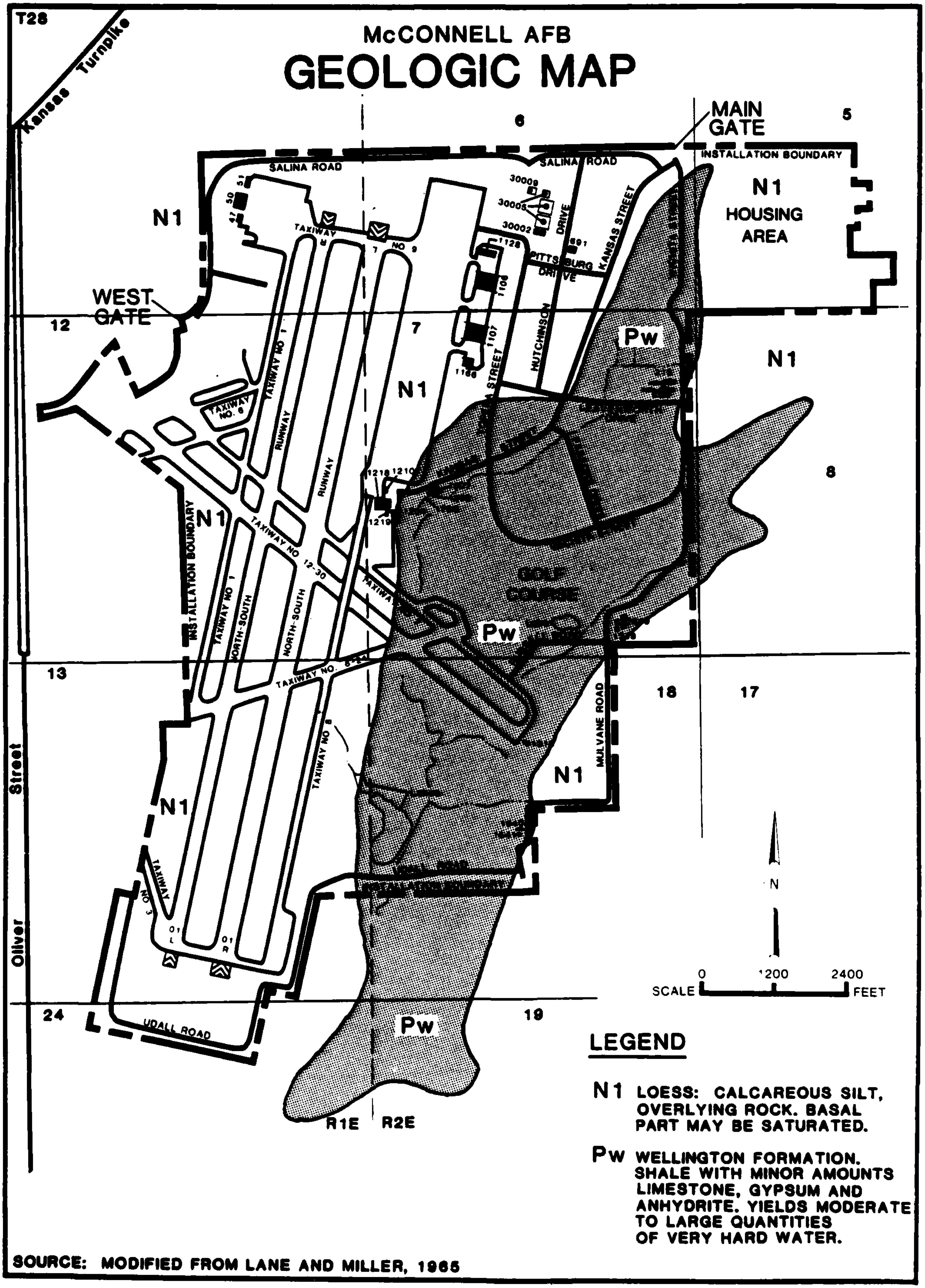
System	Series	Subseries	Stratigraphic units used in this report	Maximum thickness, feet	Physical Character	Water Supply
			Dune sand (recent)	5	Composed of fine to medium, silty sand.	Lies above the water table and does not yield water to wells.
			Alluvium and terrace deposits (Wisconsinan to Recent)	45	Composed of fine to coarse sand and fine to very coarse arkosic gravel containing only minor amounts of silt and clay that grade upward into clayey silt. Clay balls up to one foot in diameter are common in the sand and gravel.	Comprises the most widely used aquifer in the County and yields large supplies of very hard water to many wells. Wells yields up to 2,000 gpm can be developed locally. Adjacent to the Arkansas River the water is too highly mineralized for many uses.
		Upper Pleistocene	Colluvium (Illinoian to Recent)	30	A heterogeneous mixture of silt, clay, sand, gravel, and bedrock fragments deposited by slope processes.	Generally above the water table and thus yields no water to wells. Where deposits are thick and contain sand and gravel lenses, wells yielding a few gpm may be possible but would be subject to failure in dry years.
	Pleistocene		Loess (Illinoian to Recent)	74	Wind-deposited tan to pink-tan, calcareous silt, containing zones of caliche nodules and some sandy zones.	Generally above water table, but locally the basal part is saturated and sandy zones may yield some water to wells.
Neogene			Terrace deposits (Illinoisan)	75	Composed of fine to coarse sand and fine to coarse arkosic gravel that grades upward into sandy silt. Sand and gravel beds locally contain silt and clay lenses, and clay balls up to one foot in diameter are common.	Well yields of 500 gpm of good quality water are generally available from the deposits, and locally yields up to 1,000 gpm can be obtained.
		Lower Pleistocene	Undifferentiated deposits (Nebraskan and and Kansan)	157	Composed of light tan to light grey, commonly sandy, silt and clay, and fine to coarse arkosic gravel. Locally contains a lenticular bed of volcanic ash and the Pearlette ash bed of late Kansan age.	Yield small quantities of good quality water to wells in the Arkansas Valley that are screened in multiple porous zones and penetrate the complete section of unconsolidated rocks. The water is highly mineralized locally near the Arkansas River. Where present in the uplands west of the Arkansas Valley, well yields up to 50 gpm are possible locally.
	Pliocene		Ogallala(?) Formation	150±	Composed of lenticular beds of calcareous, gray to pink-tan silt and clay, fine to coarse sand, and fine to coarse gravel. The sediments reflect two sources; arkosic sand and gravel beds derived from the west are interfingered in the northern part of the County with sand and gravel beds composed of gray to tan quartz and ironstone derived from Cretaceous rocks to the north. In subsurface only.	Contributes large supplies of good quality water to many municipal, irrigation, and industrial wells screened in multiple porous zones and penetrates the complete section of unconsoliated rocks.
			Minnescah Shale	175±	Composed of alternating beds of brownish-red silty shale and siltstone, and a few thin beds of gray-green silty shale in lower part. Some gypsum is present as thin, cross-cutting and intersecting vein fillings.	Yields small quantities of water to many stock and domestic wells in the western part of the County. Water obtained from the weathered zone in the formation is generally of good quality. Water from deeper zones is generally highly mineralized but usable.
Permian	Permian		Wellington Formation	550±	Calcareous gray and blue shale containing several thin beds of impure limestone and thin beds of gypsum and and anhydrite. Some beds of maroon and gray-green shale near top of Formation. The thick Hutchinson Salt Member is present near the middle of the Formation in the western part of the County.	Yields small quantities of highly mineralized water to many stock and domestic wells east of the Arkansas River valley and in south-central part of County. Moderately large water supplies of as much as 350 gpm are available from solution zones in gypsum beds near east County line. The water is highly mineralized but usable.

Source: Modified from Lane and Miller, 1965.

TABLE 3.4
SMOKY HILL WEAPONS RANGE GEOLOGIC UNITS

System	Map Symbol	Nomenclature	Thickness, feet	Lithology	Remarks
Neogene	Nal_3	Alluvium	50	Gravel, sand, silt, clay.	Principal aquifer; may yield large quantities of water from gravel beds.
Cretaceous	Kd	Dakota Formation	200 (Combined)	Sandstone, sandy shale.	Minor aquifer; sandstone beds may yield small quantities of water seasonally.
Cretaceous	Kkc	Kiowa Shale (Cheyenne Sandstone)		Clay and shale enclosing thick, dense sandstone.	Minor aquifer; sandstone may yield small quantities of water seasonally.
Permian	Pwn	Whitehorse Sandstone (Hippewalla Group)	350	Interbedded shale, siltstone, sandstone, dolomite, anhydrite.	Poor aquifer; water is usually of poor quality; yields less than 10 gpm.

Source: Modified from Latta, 1949, Kansas Geological Survey, 1964 and Fader and Stullken, 1978.


McCONNELL AFB
GEOLOGIC MAP
T28
Kansas Turnpike
MAIN GATE
INSTALLATION BOUNDARY
SALINA ROAD
N1
HOUSING AREA
WEST GATE
TAXIWAY NO 9
PITTSBURG DRIVE
KANSAS STREET
HUTCHINSON
Pw
TAXIWAY NO 6
RUNWAY
TAXIWAY NO 1
NORTH-SOUTH
TAXIWAY NO 12-30
TAXIWAY NO 6-24
INSTALLATION BOUNDARY
GOLF COURSE
MULVANE ROAD
TAXIWAY NO 8
TAXIWAY NO 3
UDALL ROAD
Oliver Street
6
5
12
7
8
13
18
17
24
19
R1E
R2E
N
SCALE 0 1200 2400 FEET
LEGEND
N1 LOESS: CALCAREOUS SILT, OVERLYING ROCK. BASAL PART MAY BE SATURATED.
Pw WELLINGTON FORMATION. SHALE WITH MINOR AMOUNTS LIMESTONE, GYPSUM AND ANHYDRITE. YIELDS MODERATE TO LARGE QUANTITIES OF VERY HARD WATER.
SOURCE: MODIFIED FROM LANE AND MILLER, 1965

- Loess. Loess is a wind-blown silt. In some highland areas north of McConnell AFB, it reaches a maximum thickness of approximately seventy feet. In areas occupying lower or marginal topographic settings such as the base, loess may be mixed at ground surface with colluvium (materials washed downslope by unchannelized flow) to form silty clay or silty sandy clay. The loess is estimated to be on the order of five to ten feet thick over much of the installation. The loess is underlain by residuum.
- Residuum. Residuum is an unconsolidated material formed by the weathering of the parent bedrock. It may consist of clay, silt, sand and gravel and is usually unstratified. Where it is overlain by the loess, it may range in thickness from two to ten feet. In some areas, the loess has been eroded, exposing the residual materials. Where the residuum is exposed, it tends to be somewhat thinner, usually less than three feet thick.

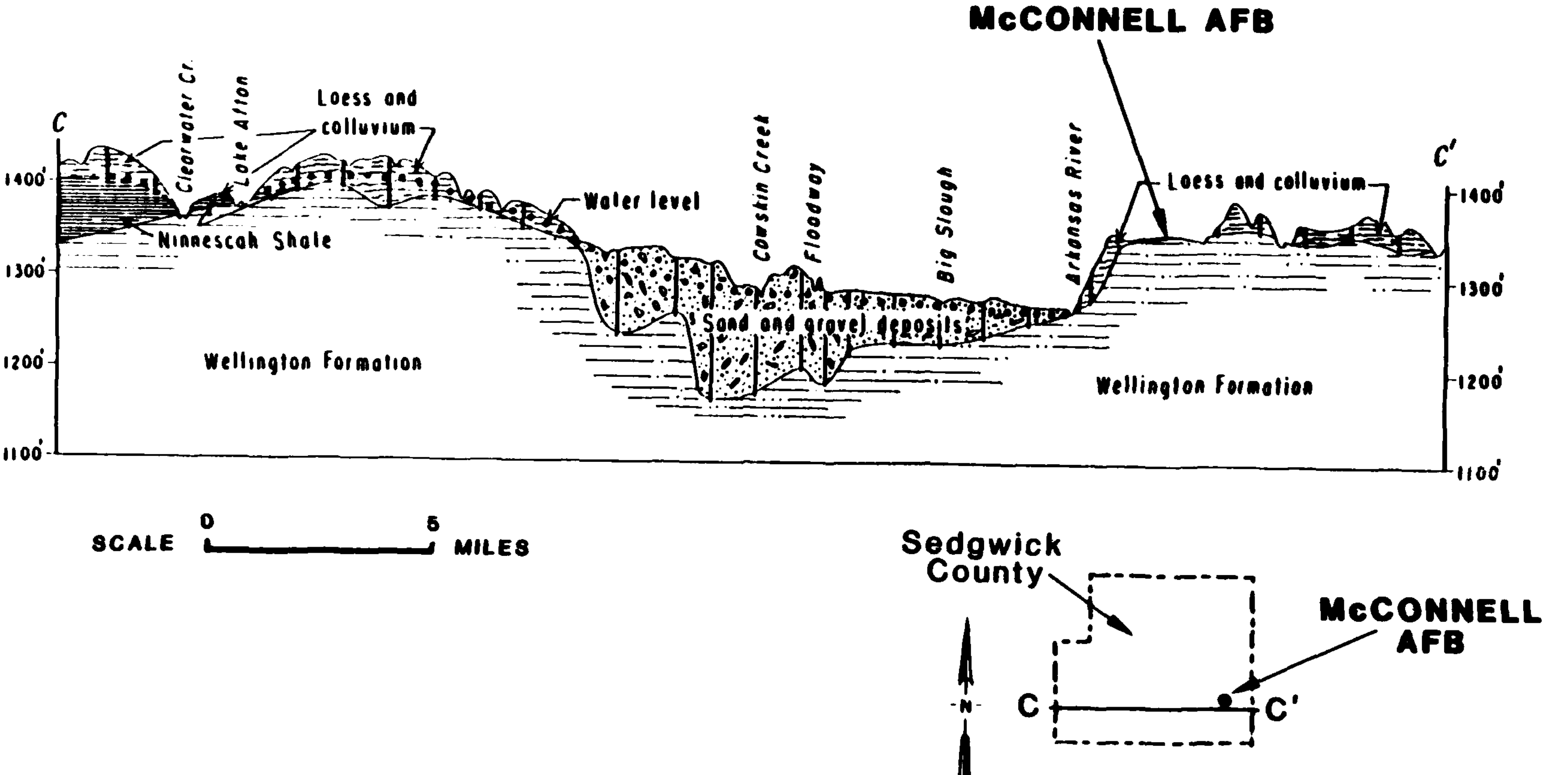
At McConnell AFB the unconsolidated materials are underlain by the Wellington Formation. Test borings at McConnell AFB indicate that the Wellington consists of sandstone and shale in the study area. Bedrock was encountered at depths of less than twenty feet below ground surface in most areas of the base and was found to occur at a depth of one foot below grade in the vicinity of Building 331. The Wellington is reported to be a thick, unfaulted unit in Sedgwick County. The unit dips gently to the west and southwest.

Figure 3.6 is an east-west geologic section drawn through Sedgwick County near the base (modified from Lane and Miller, 1965). This figure illustrates the relationship of the major units present and their stratigraphic positions within the study area.

The geology of the Smoky Hill Weapons Range is dominated by the four units summarized in Table 3.4. The unconsolidated unit, the alluvium, is limited to the major stream valleys of the Range. It consists of sand, gravel, silt and clay, which may be locally stratified and may reach a maximum thickness on the order of fifty feet.

FIGURE 3.6

McCONNELL AFB
SEDGWICK COUNTY GEOLOGIC CROSS-SECTION



SOURCE: PETRI, et al., 1964

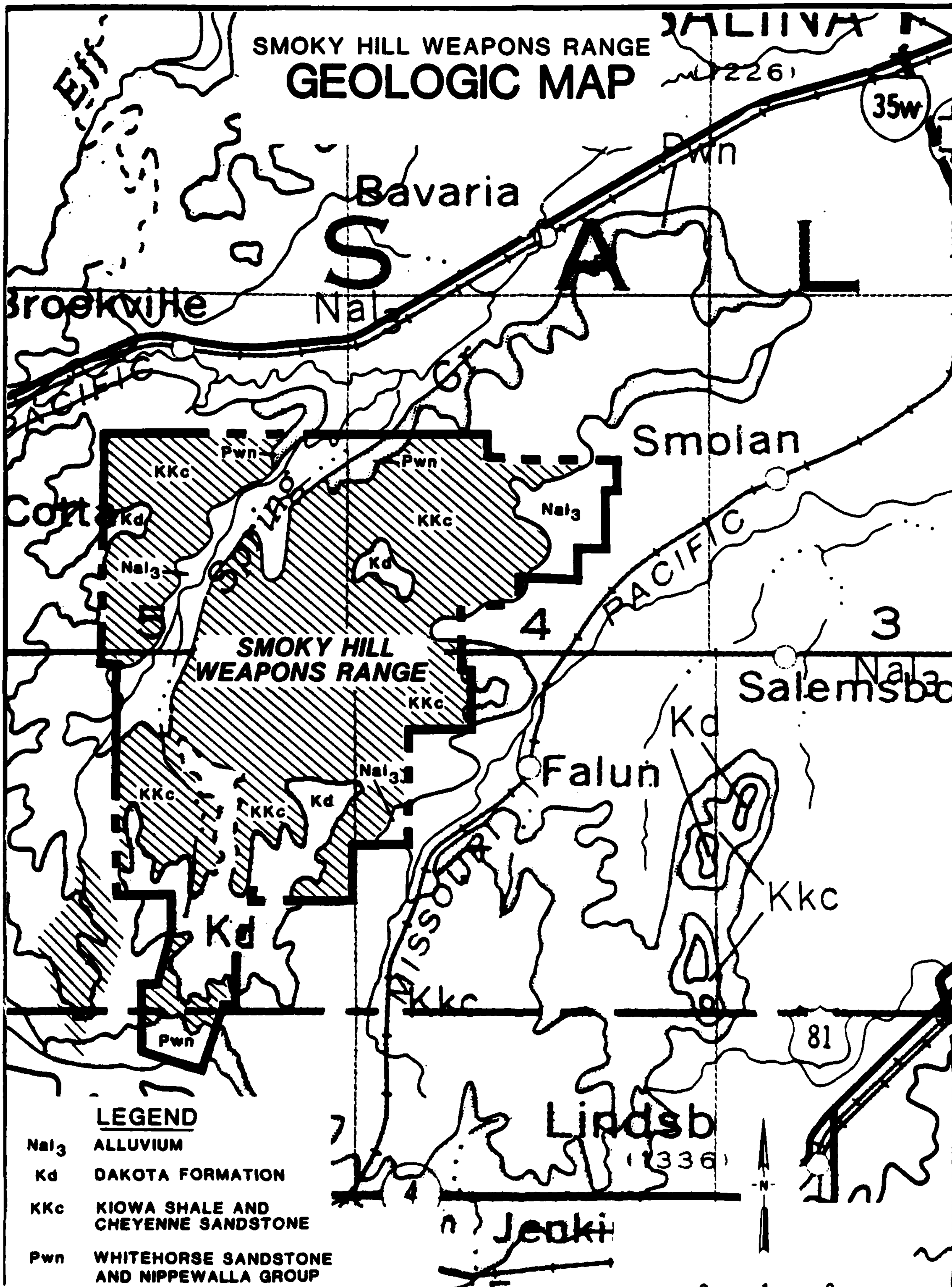
The consolidated units include the Cretaceous Dakota Formation and the Kiowa Shale (with the Cheyenne Sandstone) and the Permian Whitehorse Sandstone (with the Nippewalla Group). The Dakota and Kiowa occupy the highest topographic positions on the Range. Together, these two units consist of a two hundred foot thick accumulation of sandstone and shale. The Dakota is composed chiefly of sandstone; the Kiowa includes lenticular beds of iron-stained sandstone enclosed in thick clay and shale sequences. The hilltops are usually capped by the Dakota. The Whitehorse occupies the lower topographic positions on the Range and consists of interbedded sequences of sandstone, gypsum, shale and siltstone.

The Dakota is usually overlain by a thin sandy residual soil overburden. The Kiowa is usually overlain by a thin clayey silty overburden. The Whitehorse is typically overlain by a moderate thickness of colluvium which may consist of clay, silt and sand with some gravel or boulders. Figure 3.7 is a geologic map of the Smoky Hill Weapons Range, modified from the Geologic Map of Kansas (Kansas Geological Survey, 1964). This map shows the approximate distribution of the principle geologic units present at the Range.

The Titan site 533-2 is described here because of the requirement to rate the facility in the HARM system. Titan site 533-2 near DeGraff is underlain by the Lower Permian Chase Group, an interbedded association of partly cherty limestone and shale some 350 feet thick. The Chase Group consists of sixteen major members:

Herington Limestone	Fort Riley Limestone
Paddock Shale	Florence Limestone
Krider Limestone	Blue Springs Shale
Odell Shale	Kinney Limestone
Cresswell Limestone	Wymore Shale
Gage Shale	Schroyer Limestone
Towanda Limestone	Havensville Shale
Holmesville Shale	Threemile Limestone

Local bedrock is mantled by a relatively uniform thickness of clayey sediments and residuum.



SOURCE: KANSAS GEOLOGICAL SURVEY, 1964

HYDROLOGY

Study area hydrologic information has been reported by Latta, 1949; Williams and Lohman, 1949; Petri, et al., 1964; Lane and Miller, 1965; Bayne and Ward, 1969; Fader and Stullken, 1978; Gillespie and Hargadine, 1981; Gogel, 1981 and Kansas Geological Survey, 1983c. Additional information has been obtained from an interview with a US Geological Survey scientist.

Ground-Water Resources

McConnell Air Force Base and the Smoky Hill Weapons Range are both situated in sections of Kansas where no aquifers of regional significance exist. Two water-bearing units of minor importance are present in the study areas and are identified as follows:

- Shallow Aquifer
- Deep Aquifer

Precipitation is the primary source of ground water in the project area. A large portion of rainfall is lost as runoff directed to local surface waters or as evapotranspiration. A small amount of rainfall is able to infiltrate downward until it reaches a level in the unconsolidated deposits where all available voids between soil particles are water-filled. Water contained in these void spaces is called ground water and is constantly in motion. Ground water tends to move from points where it enters the subsurface (recharge areas, where water levels are highest) to discharge areas (where the water levels are lowest). A review of available data, topographic and surface water information and site inspections suggest that most of McConnell AFB and the Smoky Hill Weapons Range are located in the recharge zones of the uppermost aquifers. Ground water moving from the recharge zones may flow into hydraulically communicating hydrogeologic units, recharging them, or may be directed into local surface waters as base flow (that portion of stream flow contributed by ground water). The actual directions of flow, flow velocities, etc., for each water-bearing unit present on the installations must be treated as an individual case. The following discussion describes the significant properties of the water-bearing units considered to be relevant to this investigation.

The shallow aquifer present at McConnell AFB is generally more permeable than underlying geologic units (for example, bedrock) and is most likely to be the initial receptors of migrating contamination. Therefore, the shallow aquifer is probably the most important hydrogeologic unit relevant to a waste-migration study. The shallow aquifer is not, however, completely defined in the study area. The literature currently available (Petri, et al. 1964; Lane and Miller, 1965) suggests that the principle near-surface source of ground water is the unconsolidated materials overlying bedrock. These unconsolidated materials consist of loess (or loess mixed with colluvium) and residuum. The unit varies in thickness across the installation from approximately three to twenty feet. Lane and Miller (1965) report that the lower extent of the unit may be saturated.

Numerous installation test borings advanced in support of base construction projects in the industrial and administrative areas of McConnell AFB encountered ground water in the unconsolidated deposits. Where ground water was encountered, (five to fifteen feet below grade) it was usually found to be present in the lower part of the unconsolidated materials, just above bedrock. The extent, thickness, persistence, etc., of this shallow water-bearing unit are unknown. It is assumed that the shallow aquifer is recharged in much of the base area by precipitation. Discharge is likely directed downward to underlying aquifers or to local surface waters. The direction of ground-water flow within this unit is probably influenced by local topography. The unconsolidated materials present on McConnell AFB are probably not a reliable source of water supplies as they may run dry seasonally.

The Wellington Formation (bedrock) is the deep aquifer present in the McConnell AFB study area. The Wellington contains water in secondary openings such as solution channels, bedding planes, fractures and fissures present in the shale, limestone, anhydrite and gypsum beds comprising the unit. Where they occur near the surface, the gypsum beds have been partially or in some cases, completely removed by solution activity. The Wellington may be recharged to some degree where it occurs at or near ground surface on McConnell AFB (refer to Figure 3.5). It may contain ground water under water table (unconfined) conditions in its upper extent or artesian (confined) conditions in deeper zones. The

direction of ground-water flow in this unit relative to McConnell AFB is unknown. The Wellington is used as a source of water supplies in areas generally east of the Arkansas River valley. Shallow dug wells constructed into the residual soil zone and the soft upper margin delineating the top of rock provide sufficient quantities of water for domestic or stock water purposes. Shallow wells installed into the Wellington may run dry during prolonged drought periods. Deep wells installed into fracture or solution zones within the unit may be more reliable and supply larger quantities of water than the shallow wells. A few solution zones form springs discharging ground water to local streams where gypsum or anhydrite beds are exposed at ground surface.

Two water-bearing units are present at the Smoky Hill Weapons Range. They include alluvium and bedrock. The alluvium consists of clay, silt, sand and gravel, averaging fifty feet in total thickness. Its distribution is limited to the stream valleys extending through the Range. It is somewhat thicker in its upper extent and may contain gravel beds in its lower extent. The alluvium is recharged directly by precipitation or by streamflow. Ground water is likely present in the unit under water table conditions. It has been reported to be a reliable source of large quantities of ground water. The direction of ground-water flow within this unit probably mirrors the topographic surface, however, local variations may occur.

The bedrock present in the Smoky Hill Weapons Range is known to be overlain by varying thicknesses of residual soil or a loess and alluvium mixture. The water-bearing properties of these units are uncertain.

The consolidated aquifers potentially available for use in the Range study area include the Dakota Sandstone and sandstone beds within the Kiowa Shale. The Dakota consists of sandstone and sandy shale which caps many of the hills present in the study area. It is underlain by the Kiowa. Together, they are estimated to be approximately 200 feet thick in the study area. The Dakota may be a useful source of small quantities of water, however, shallow wells constructed into it may run dry during prolonged drought periods.

The sandstone beds enclosed within the Kiowa may provide reliable water supplies locally; at the City of Gypsum in southeast Saline County, a municipal water distribution system utilizes wells constructed

into the same sandstone unit. In other areas, the sandstone may not yield sufficient quantities of water to sustain the needs of a municipality. It is thought that in the vicinity of Smoky Hill Weapons Range the sandstone may only provide adequate supplies for domestic or stock watering purposes in western Saline County. The consolidated water-bearing units are recharged by precipitation where they occur at or near ground surface, which is the case in the Range study area. Ground-water flow directions and discharge points for these units are unconfirmed. It is assumed that ground water contained in the bedrock aquifers would be directed downgradient to communicating aquifers (such as the alluvium) or to local streams.

Ground water may be obtained at moderate depths from the bedrock at Titan Site 533-2. Small quantities may be derived from the weathered zone marking the top of rock and large quantities can be pumped from the solution cavities within the limestone. Bedrock aquifers are probably recharged directly by precipitation where they crop out (occur near ground surface). Local ground-water flow directions and velocities are not known.

Study Area Ground-Water Use

The use of ground water in the McConnell AFB area is limited by several factors:

- Large quantities of good quality supplies are available from the municipal (City of Wichita) distribution system at modest cost.
- A usable aquifer may not exist at a particular locality.
- The quality of local ground-water supplies is highly variable and may not be suitable at a particular locality.

Historically, it was common practice to construct large-diameter (dug) wells into the base of the loess or the residuum overlying local bedrock. Generally, this type of well was capable of furnishing adequate supplies of water for domestic or stock watering purposes, but could run dry during extended droughts. Typically, the large-diameter dug well was constructed to depths of less than forty feet below ground surface.

A few such wells may remain in service at locations east and southeast of McConnell AFB.

Ground-water supplies are not known to be obtained from the permeable solution channels within the Wellington Formation's gypsum beds underlying the McConnell AFB study area. It has been reported that water obtained from the gypsum beds is believed to be too salty for use (Lane and Miller, 1965, page 55). Ground water is probably not obtainable from other beds within the Wellington Formation as these tend to be relatively tight and do not readily give up water to wells.

The locations of the known wells relative to McConnell AFB are shown on Figure 3.8. It must be noted that other privately owned wells may be in use near the installation. An inventory of all wells currently in use near the base would require a house-by-house inquiry.

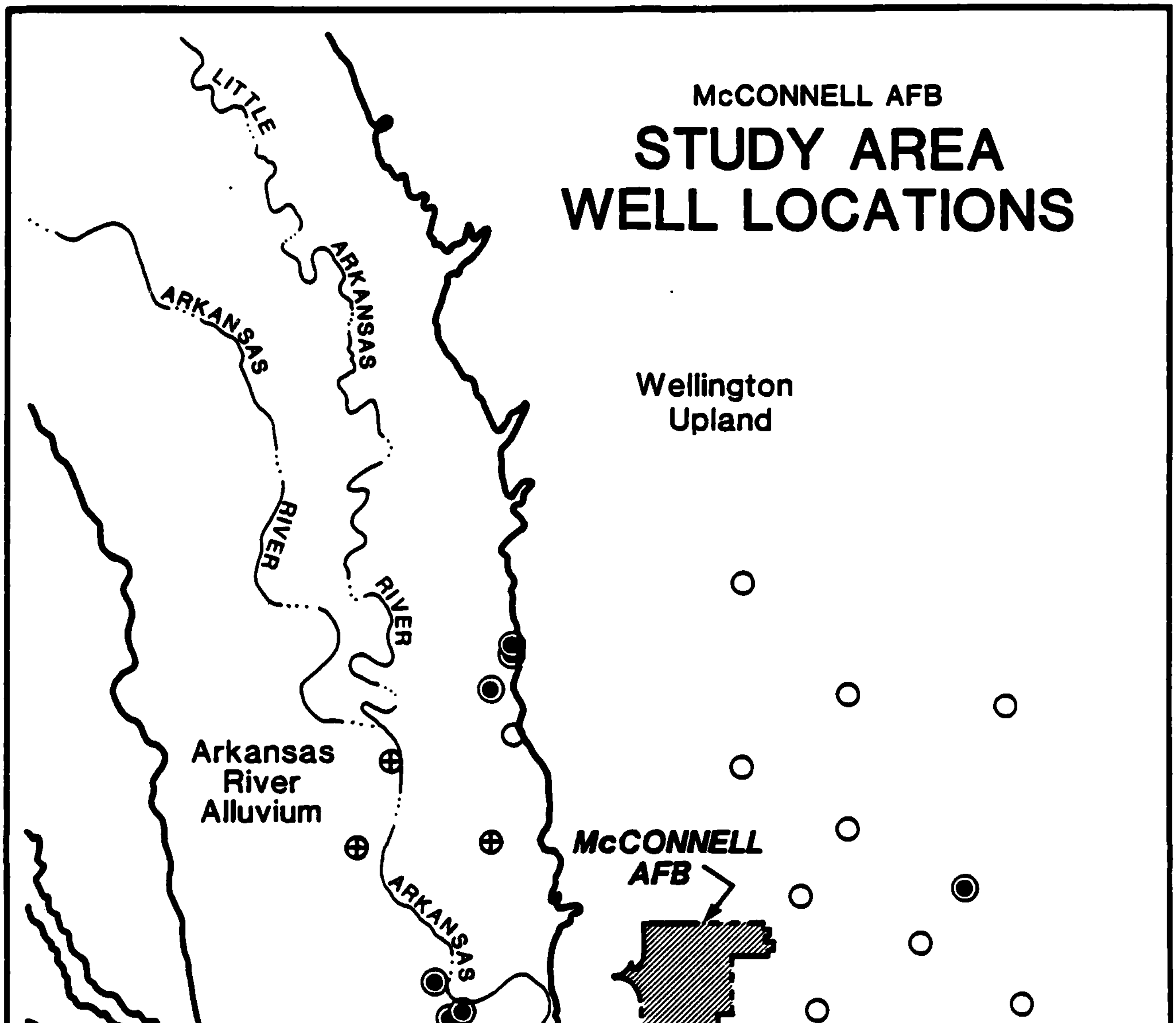
At the Smoky Hill Weapons Range, ground water may be obtained from stream channel alluvium, the Dakota Sandstone or the sandstone member enclosed within the Kiowa Shale. Wells finished into either sandstone should be capable of providing adequate quantities of ground water for stock watering or domestic purposes. The alluvium present in the valleys of major area streams is reported to be capable of furnishing large quantities of water to wells. It is the principal source of potable water supplies for the communities of Brookville, Bavaria, Salina, Smolan and Falun.

The Smoky Hill Weapons Range utilizes two wells. The first well serves the Range Headquarters. It is reported to be 200 feet deep and is probably finished into the alluvial deposits of Spring and Ralston Creeks. The second well furnishes water to the Range Operations Center and is reported to be 75 feet deep. It is likely finished into sandstones of the Dakota or Kiowa formations.

Ground water resources are utilized extensively in the vicinity of Titan Site 533-2, primarily for domestic, agricultural and livestock watering purposes.

Ground-Water Quality

The quality of McConnell AFB study area ground water has been reported by Williams and Lohman, 1949; Petri, et al., 1964, Lane and Miller, 1965; Gogel, 1981. It has been generally recognized that ground water obtained from the Arkansas River valley alluvium is probably the



ES ENGINEERING-SCIENCE

best available in the study area and consumers located in the alluvial valley would use it as a source of water. Consumers located outside the alluvial valley (i.e. the Wellington) typically do not install their own wells but prefer to purchase water supplies from the City of Wichita. During their study of Sedgwick County geohydrology, Lane and Miller (1965) divided the county into "Ground-Water Areas" in accordance with local conditions, availability, quality, etc. McConnell AFB and its environs have been assigned to Ground-Water Subarea C 2, also called the Wellington Shale Upland. They concluded that this subarea is the most difficult area in the county to obtain ground water supplies. Ground water obtained from the unconsolidated deposits present at the base (loess and residuum) may provide meager quantities of extremely hard, mineralized water. Ground water obtained from bedrock (the gypsum beds in the Wellington Formation) produce water too salty for use.

Gogel (1981) reported that saline water was being discharged from the Hutchinson Salt member and gypsum beds within the Wellington Formation to several stream-aquifer systems in central Kansas. The solution weathering is caused by leakage from overlying unconsolidated deposits such as those in the Arkansas River valley, into the underlying bedrock of the Wellington Formation. The leakage has resulted in the formation of a discontinuous zone of collapsed strata and solution cavities extending from Salina to Wellington and has been termed the Wellington aquifer. The Wellington, in turn, has been discharging highly contaminated (saline) water back to local streams and aquifers at Belle Plaine, Adamsville, Geuda Springs and in an area east of Salina. The increased chloride-load to the Arkansas River and its tributaries was measured between Derby and Arkansas City during the period 1970-1974 (Gillespie and Hargadine, 1981). The average naturally occurring chloride load increase to the river system was estimated to be 294 tons per day (Gogel, 1981). Studies are in progress to fully characterize the problem and to determine control methods.

Information describing the quality of ground water in the Smoky Hill Range study area has been obtained from Latta (1949) and from Gillespie and Hargadine (1981). Generally, ground water obtained from the alluvium of the Smoky Hill River and its tributaries is the best available in the study area. However, the water is hard (100-200 mg/l)

to very hard (>200 mg/l) and may contain excessive levels of chloride, calcium, iron, magnesium and sulfate. Natural degradation of the Smoky Hill River alluvium has been reported by Gillespie and Hargadine (1981). Chloride discharge from the Wellington aquifer (local bedrock) to the alluvium and then to the Smoky Hill and Solomon Rivers occurs near Solomon, between Salina and Abilene. The increased chloride load has been estimated to range from 150 to 370 tons per day. A test well installed into the Wellington aquifer just below the alluvium at Soloman, encountered contaminant levels averaging 5,700 mg/l of sulfate and 170,000 mg/l chloride. The natural degradation of local surface waters is a source of concern and is the object of continuing study.

It has been reported that small supplies of water can be obtained from the Dakota Sandstone or sandstone enclosed within the Kiowa Shale at the Smoky Hill Weapons Range. Data describing the quality of ground water obtained from these hydrogeologic units was not available for review.

The quality of ground water obtained from the vicinity of Titan Site 533-2 is reported to range from good to poor. Most water supplies derived from bedrock aquifers is typically hard or very hard.

Base Water Supplies

McConnell Air Force Base and other major study area consumers obtain their water supplies from the City of Wichita municipal distribution system, which utilizes the conjunctive use of both surface and ground-water sources. Surface water from Cheney Reservoir is mixed with ground water obtained from the well known "Equus beds" and the Sim Park wells located in the City of Wichita. The Equus beds, also known as the Wichita well field is a thick alluvial sequence deposited by the Little Arkansas and Arkansas Rivers in the areas between Halstead and Bentley, northwest of Wichita. The Sim Park wells in Wichita are finished into alluvial sediments of the Arkansas River valley. Water obtained from surface water sources in the study area is generally of poor quality; therefore, it is mixed with ground water to improve both the quality and quantity of water available for use. The city distribution system furnishes ample supplies of good quality water to McConnell AFB. The quality of base water supplies is monitored routinely by the McConnell AFB BES.

Smoky Hill Weapons Range obtains its water supplies from the two existing wells on-site. No major problems have been reported with the water supply and the water quality is adequate. Range water supply quality is monitored by the McConnell AFB Bioenvironmental Engineering Section (BES).

Surface Water Resources

McConnell Air Force Base is located in the Arkansas River Basin of south central Kansas. Installation surface water drainage is directed to an unnamed tributary of the Arkansas River, which extends through the base and then to the major stream (Figure 3.2). The unnamed tributaries and the drainage alignments on base are ephemeral streams that only flow during part of the year when sufficient runoff is available. When flowing, the tributary conducts drainage directly to the Arkansas River. Base surface waters are not assigned water use classifications in the regulations promulgated by the State of Kansas (Kansas Department of Health and Environment, 1983); however, the Arkansas River is classified. Streams draining to a classified surface water must not be permitted to degrade the regulated stream to a point less than its intended use. The Arkansas River has been assigned to Water Use Classification B which includes the following beneficial uses:

- Secondary contact recreation
- Propagation of fish and wildlife
- Public water supply
- Industrial water supply
- Agricultural purposes

The drainage of Smoky Hill Weapons Range is accomplished by the following ephemeral streams: Spring Creek, Castle Creek, Ralston Creek and West Dry Creek, which drain to the Solomon River and by several unnamed tributaries which drain to the Smoky Hill River. The streams crossing the Range are not listed in the specific use classifications (Kansas Department of Health and Environment, 1983). However, both the Solomon River and the Smoky Hill River are assigned the same water use classification (B), as is the Arkansas River. Discharges or drainage directed to a classified surface water segment must not degrade the

regulated stream to a point less than the specified minimum standards. The specified minimum standards for Class B waters is as follows:

- Dissolved oxygen — $\geq$ 5.0 mg/L
- pH — 6.5 - 8.5
- Temperature — 32 degrees C (<3 degrees C increase)
- Ammonia — 0.5 mg/L
- Oil and grease — No visible sheen

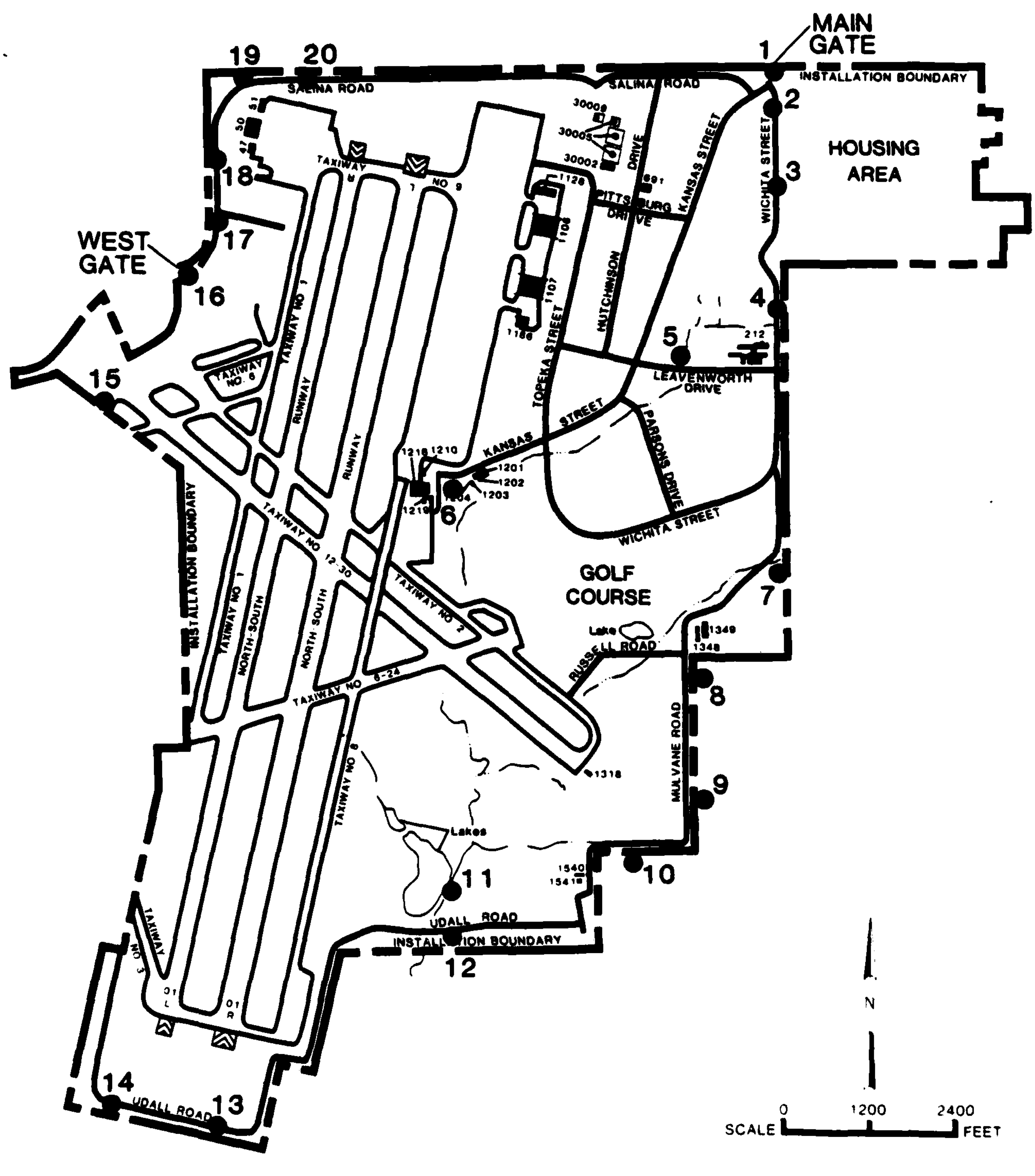
Surface Water Quality Monitoring

Surface water quality monitoring is conducted on a routine basis at McConell AFB at the twenty locations depicted on Figure 3.9 by the base BES. Because the streams flowing on the installation do so intermittently, sampling and subsequent analyses are performed in a like manner. A review of base water quality monitoring data for calendar year 1984 indicates that base surface water quality has been acceptable. A comparison of stream influent and effluent data suggests that base activities (on the sampling dates) did not degrade stream water quality and conformed to the specified requirement of the major receiving water. Table 3.5 summarizes McConnel AFB Surface Water Quality monitoring data for 1984.

THREATENED AND ENDANGERED SPECIES

The land area of McConnell AFB includes 3,059 acres, of which approximately 190 acres is classified as unimproved property which is outleased for agricultural purposes. The unimproved sections are primarily limited to the areas just east of the military family housing area and the zone north and west of Udall Road, adjacent to the secondary runway. Small isolated fields are located throughout the Figure 3.9 installation. No wetlands zones have been identified on base. Base vegetation consists of common varieties of grasses and weeds and several types of trees including red cedar, elm, pine, and osage orange. This mixture of vegetation provides suitable habitat to an assortment of small animals, birds and insects. No known threatened or endangered animal species is known to be in permanent residence at McConnell AFB.

McCONNELL AFB
WATER QUALITY MONITORING LOCATIONS



SOURCE: INSTALLATION DOCUMENTS

TABLE 3.5

MCCONNELL AFB SURFACE WATER QUALITY MONITORING SUMMARY FOR CALENDAR YEAR 1984

Chemical	Site No. 2 MFH #1 Runoff	Site No. 5 Base Stream	Site No. 6 Base Separator	Site No. 11 Base Lake	Site No. 12 South Effluent	Site No. 14 South Effluent	Kansas Compliance Standard (Classification B)
Dissolved Oxygen	4.0 mg/L	7.5 mg/L	6.0 mg/L	11.4 mg/L	6.8 mg/L	6.0 mg/L	>5 mg/L
pH	7.0	7.4	7.1	6.25	6.5	7.0	6.5-8.5
Temperature	2.2 C	16.7 C	18.4 C	18.75 C	16.4 C	3.3 C	32 C Max, <3 C Rise
Ammonia	0.2 mg/L	0.2 mg/L	3.4 mg/L	<0.2 mg/L	0.2 mg/L	0.7 mg/L	0.15 mg/L
Chloride	48. mg/L	50. mg/L	32. mg/L	10.6 mg/L	37.3 mg/L	20. mg/L	-
Nitrate	0.9 mg/L	0.58 mg/L	0.2 mg/L	0.1 mg/L	0.1 mg/L	1.0 mg/L	-
Oils & Grease	<0.3 mg/L	0.4 mg/L	0.9 mg/L	0.4 mg/L	0.4 mg/L	<0.3 mg/L	No Visible Sheen
Phenols	<0.01 mg/L	<0.01 mg/L	0.023 mg/L	<0.01 mg/L	0.097 mg/L	<0.01 mg/L	-
Surfactants	<0.1 mg/L	<0.1 mg/L	0.1 mg/L	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L	-
Non-Filterable Solids	26 mg/L	<0.1 mg/L	19.5 mg/L	7.0 mg/L	4 mg/L	4 mg/L	-
Turbidity	23 TU	3.0 TU	5.6 TU	4.3 TU	3 TU	3 TU	-
Arsenic	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	-
Barium	<0.2 mg/L	<0.21 mg/L	<0.2 mg/L	<0.2 mg/L	<0.2 mg/L	<0.2 mg/L	-
Beryllium	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	-
Cadmium	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	-
Chromium (Total)	<0.05 mg/L	<0.05 mg/L	<0.05 mg/L	<0.05 mg/L	<0.05 mg/L	<0.05 mg/L	-
Copper	<0.02 mg/L	<0.02 mg/L	<0.02 mg/L	<0.02 mg/L	<0.02 mg/L	<0.02 mg/L	-
Lead	<0.02 mg/L	<0.02 mg/L	<0.02 mg/L	<0.02 mg/L	<0.02 mg/L	<0.02 mg/L	-
Magnesium	0.005 mg/L	0.001 mg/L	0.018 mg/L	0.005 mg/L	0.007 mg/L	0.037 mg/L	-
Mercury	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	-
Nickel	<0.05 mg/L	<0.005 mg/L	0.051 mg/L	<0.05 mg/L	<0.05 mg/L	<0.05 mg/L	-
Selenium	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	-
Silver	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	-
Zinc	<0.05 mg/L	<0.05 mg/L	0.057 mg/L	<0.05 mg/L	<0.05 mg/L	0.067 mg/L	-
Chlordane	<0.20 mg/L	ND	<0.02 mg/L	<0.02 mg/L	<0.20 mg/L	ND	-
Heptachlor	<0.01 mg/L	ND	<0.20 mg/L	<0.20 mg/L	<0.20 mg/L	ND	-

Note: Sites, 1, 3, 4, 7-10, 13, and 15-20 were dry at time of sampling; "-" indicates no applicable standard.
Source: Installation Documents

The Smoky Hill Weapons Range consists of 33,873 acres, of which 26,696 acres is leased for agricultural and livestock purposes. Most of the area consists of grassy rangeland. About 842 acres are forested. Trees common to the Range include oak, ash, hackberry, hedge, elm, cottonwood, willow, cedar, walnut and locust. Range vegetation supports a wide variety of small game, deer, fish and birds. No threatened or endangered animal species have been identified on the Range.

SUMMARY OF ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation indicate that the following elements are relevant to the evaluation of past hazardous waste management sites at McConnell AFB:

- The mean annual precipitation is 32.3 inches and net annual precipitation is calculated to be minus 25.7 inches. Smoky Hill Weapons Range annual precipitation is 28 inches, net annual precipitation is minus 28 inches.
- Localized flooding may be a problem at the base in the area adjacent to the Main Gate.
- No wetlands have been identified on the installation or the Smoky Hill Weapons Range.
- Base upland surface soils are predominantly silty or clayey and possess low permabilities. They are underlain by low permeability shale bedrock. Soils presents in the channels of base streams are silty sands and are somewhat more permeable. Extensive sand and gravel zones probably underlie the stream channel materials.
- Two aquifers of minor importance have been identified on base. A shallow aquifer, present at or near land surface, is composed of upland clayey sediments. A bedrock aquifer also underlies the base.
- Two aquifers are present at the Smoky Hill Weapons Range. An alluvial aquifer is present in the major stream valleys. The bedrock aquifer may be present at or near ground surface in most of the Range's upland areas.

- Shallow aquifer ground water was encountered at the base hospital at a depth of some five to fifteen feet below land surface. The depth to water in the deep (rock) aquifer is unknown. The depth to ground water in Range aquifers is unknown.
- The shallow aquifer (and probably the deep aquifer) receive recharge from precipitation or infiltration through streambeds within the base boundaries.
- All of the water-bearing zones identified on base probably communicate hydraulically to some degree. During periods when area water levels are highest, the shallow aquifer likely discharges (provides base flow) to local streams.
- The shallow aquifer identified on base may be a source of water supplies to consumers located one mile east from McConnell AFB.
- Most study area consumers, both institutional and individual, obtain potable water supplies from the City of Wichita municipal system. The Wichita system obtains its water supplies from a surface source, Cheney Reservoir, located thirty miles northwest of the base and from the municipal well system located five to fifteen miles northwest of the installation in the Arkansas River alluvium. The municipal wells obtain ground water resources from an aquifer which does not underlie McConnell AFB.
- Historic water quality data indicates that base surface water generally conforms to the standard required for the designated use classifications of local streams.
- Unnamed tributaries of the Arkansas River on base are ephemeral streams; they contain moving water only when sufficient runoff is available to support flow.
- No threatened or endangered species have been identified on the base or on the Smoky Hill Range.

It may be seen from these key environmental factors that potential pathways facilitating the migration of hazardous waste-related contamination exist. Hazardous waste constituents present at ground surface could potentially be mobilized to the shallow aquifer on base and subsequently to the communicating deep (bedrock) aquifer, or directly to

local surface waters. It is believed that in the event of a migration scenario, pollutants would exit the base via the unnamed Arkansas River tributaries and eventually be discharged into the major stream. In this situation, the primary receptors of base-related contamination would be the shallow aquifer on base and the Arkansas River.

Contaminants migrating from sites at the Smoky Hill Weapons Range may be discharged either to proximate shallow aquifers (either bedrock or alluvial) or to local streams.

SECTION 4

FINDINGS

This section summarizes the hazardous wastes generated by installation activities, identifies hazardous waste accumulation and disposal sites located on the installation, and evaluates the potential environmental contamination from hazardous waste sites. Past waste generation and disposal methods were reviewed to assess hazardous waste management practices at McConnell AFB.

INSTALLATION HAZARDOUS WASTE ACTIVITY REVIEW

A review was made of past and present installation activities that resulted in generation, accumulation and disposal of hazardous wastes. Information was obtained from files and records, interviews with past and present installation employees and site inspections.

It is noted that file data and interviews did not enable determination of most waste handling activities prior to about 1955. From the historical descriptions of the training activities at the base, it is believed that the generation rate of hazardous materials prior to this date was small.

The sources of hazardous waste at McConnell AFB are grouped into the following categories:

- o Industrial Operations (Shops)
- o Waste Accumulation and Storage Areas
- o Fuels Management
- o Spills and Leaks
- o Pesticide Utilization
- o Fire Protection Training

The subsequent discussion addresses only those wastes generated at McConnell AFB which are either hazardous or potentially hazardous.

Potentially hazardous wastes are grouped with and referenced as "hazardous wastes" throughout this report. A hazardous waste, for this report, is defined by, but not limited to, The Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). Compounds such as polychlorinated biphenyls (PCB) which are listed in the Toxic Substances Control Act (TSCA) are also considered hazardous. For study purposes, waste petroleum products such as contaminated fuels, waste oils and waste nonchlorinated solvents are also included in the "hazardous waste" category.

No distinction is made in this report between "hazardous substances/materials" and "hazardous wastes". A potentially hazardous waste is one which is suspected of being hazardous although insufficient data are available to fully characterize the material.

Industrial Operations (Shops)

Summaries of industrial operations at McConnell AFB were developed from installation files and interviews. Bioenvironmental Engineering Section (BES) provided a list of industrial shops and individual shop files indicating current waste generation and hazardous material disposal practices. Information obtained was used to determine which operations handle hazardous materials and which ones generate hazardous wastes. Summary information on all installation shops is provided as Appendix E, Master List of Shops.

For the shops identified as generating hazardous wastes, file data was received and personnel were interviewed to determine the types and quantities of materials and present and past disposal methods. Information developed from base files and interviews with installation employees summarized in Table 4.1. Industrial operations at McConnell AFB were grouped into 16 main units:

- 381 Missile Maintenance Squadron
- 384 Supply Squadron
- 384 Transportation Squadron
- 384 Avionics Maintenance
- 384 Field Maintenance Squadron
- 384 Organizational Maintenance Squadron

TABLE 4.1
INDUSTRIAL OPERATIONS (Shops)
Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950–1980)
381 MISSILE MAINTENANCE SQUADRON				
CORROSION CONTROL	1107	ALODINE	4 GALS./YR.	DPDO
ELECTRONICS LAB	1107	POTASSIUM HYDROXIDE	12 GALS./YR.	SANITARY SEWER
		SULFURIC ACID	12 GALS./YR.	SANITARY SEWER
FACILITY SUPPORT	1107	DIESEL FUEL	50 GALS./YR.	FPTA → BOILER → BOILER DPDO
		LUBE OIL	200 GALS./YR.	FPTA → BOILER → BOILER DPDO
		WATER TREATING CHEMICALS	24 GALS./YR.	SANITARY SEWER
PNEUDRAULIC SHOP	1107	HYDRAULIC FLUID	6,600 GALS./YR.	FPTA → BOILER/DPDO → DPDO
		PD 680	660 GALS./YR.	FPTA → DPDO

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

FPTA: FIRE PROTECTION TRAINING AREA

DPDO: DEFENSE PROPERTY DISPOSAL OFFICE

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
381 MISSILE MAINTENANCE SQUADRON (CONT'D)				
PROPELLANT CLEANING ROOM	1107	TRIETHANOLAMINE	110 GALS./YR.	T-2 TANK/ NEUTRALIZED TO SANITARY SEWER
		HYDROXYACETIC ACID	110 GALS./YR.	T-2 TANK/ NEUTRALIZED TO SANITARY SEWER
		INORGANIC ACIDS	72 GALS./YR.	T-2 TANK/ NEUTRALIZED TO SANITARY SEWER
PROPELLANT TRANSFER SERVICES	1107	NITROGEN TETRAOXIDE	5 GALS./YR.	T-2 TANK/ NEUTRALIZED TO SANITARY SEWER
		AEROZINE 50	5 GALS./YR.	T-2 TANK/ NEUTRALIZED TO SANITARY SEWER
		AMMONIA	5 GALS./YR.	T-2 TANK TO SANITARY SEWER
384 SUPPLY SQUADRON				
BULK FUELS STORAGE/LOX	965	JP-4	3,000 GALS./YR.	FPTA
FUELS LABORATORY	990	JP-4 & DIESEL FUEL	800 GALS./YR.	FPTA

KEY

———— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

------ ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

FPTA: FIRE PROTECTION TRAINING AREA

DPDO: DEFENSE PROPERTY DISPOSAL OFFICE

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 1960 1970 1980)
384 TRANSPORTATION SQUADRON				
DIAGNOSTIC Q & A	710	ENGINE OIL	660 GALS./YR.	FPTA → BOILER/DPDO
		HYDRAULIC FLUID	160 GALS./YR.	FPTA → BOILER/DPDO
		SULFURIC ACID	120 GALS./YR.	NEUTRALIZED TO SANITARY SEWER
FIRE TRUCK MAINTENANCE	1201	PD-680	30 GALS./YR.	FPTA → BOILER/DPDO
		ENGINE OIL	100 GALS./YR.	FPTA → BOILER/DPDO
GENERAL PURPOSE MAINTENANCE	710	GASOLINE	25 GALS./YR.	FPTA → BOILER/DPDO
		GASOLINE (UNLEADED)	28 GALS./YR.	BOILER/DPDO
		DIESEL FUEL	25 GALS./YR.	FPTA → BOILER/DPDO
		ENGINE OIL	120 GALS./YR.	FPTA → BOILER/DPDO
REFUELING MAINTENANCE	980	ENGINE OIL	108 GALS./YR.	FPTA → BOILER/DPDO
		ANTIFREEZE	18 GALS./YR.	DPDO
		PD-680	20 GALS./YR.	FPTA → DPDO
		JP-4	3,600 GALS./YR.	OIL/WATER SEPARATOR/DPDO
SPECIAL PURPOSE MAINTENANCE	1111	OIL	700 GALS./YR.	FPTA → BOILER/DPDO

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

FPTA: FIRE PROTECTION TRAINING AREA

DPDO: DEFENSE PROPERTY DISPOSAL OFFICE

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
384 AVIONICS MAINTENANCE				
PRECISION MEASUREMENT LABORATORY	1099	MERCURY	<1 GAL./YR.	DPDO
384 FIELD MAINTENANCE SQUADRON				
AEROSPACE GROUND EQUIPMENT SHOP	1171	SYNTHETIC OIL	72 GALS./YR.	FPTA → BOILER/DPDO → DPDO
		MINERAL OIL (NON PCB)	2,000 GALS./YR.	FPTA → DPDO
		HYDRAULIC FLUID	360 GALS./YR.	FPTA → BOILER/DPDO → DPDO
		PD 680	600 GALS./YR.	FPTA → DPDO
CORROSION CONTROL	1169	PAINT STRIPPER (EPOXY)	100 GALS./YR.	FPTA → HOLDING TANKS/DPDO → HOLDING TANKS/SANITARY SEWER
		WASTE PAINT	326 GALS./YR.	ON BASE LANDFILL → OFF BASE LANDFILL
		SOLVENTS (MEK, TOLUENE, THINNER, DIMETHYLFORMAMIDE)	1,320 GALS./YR.	FPTA → HOLDING TANKS/DPDO → DRUMS TO DPDO
ELECTRIC BATTERY SHOP	1169 1171	NICKEL CADMIUM BATTERIES	800 BATTERY CASES/YR.	DPDO
		LEAD ACID BATTERIES	60 BATTERY CASES/YR.	DPDO
		SULFURIC ACID	30 GALS./YR.	NEUTRALIZED TO SANITARY SEWER

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

FPTA: FIRE PROTECTION TRAINING AREA

DPDO: DEFENSE PROPERTY DISPOSAL OFFICE

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
ENGINE CONDITIONING SHOP	1169	OIL	50 GALS./YR.	FPTA → BOILER/DPDO
FUEL SYSTEMS REPAIR SHOP	1166	JP-4	50 GALS./YR.	OIL/WATER SEPARATOR/DPDO
JET ENGINE INTERMEDIATE MAINTENANCE	1169	OIL	240 GALS./YR.	FPTA → BOILER/DPDO
		JP-4	240 GALS./YR.	FPTA → FPTA/DPDO
		PD-680	110 GALS./YR.	FPTA → DPDO
NON DESTRUCTIVE TESTING	1219	FLUORESCENT DYE PENETRATING OIL	200 GALS./YR.	FPTA → DPDO
		FIXER	240 GALS./YR.	SANITARY SEWER → SILVER RECOVERY/ SANITARY SEWER
		DEVELOPER	240 GALS./YR.	SANITARY SEWER
PNEUDRAULICS SHOP	1169	PD-680	220 GALS./YR.	FPTA → DPDO
REPAIR & RECLAMATION SHOP	1106	PD 680	200 GALS./YR.	FPTA → DPDO
QUICK START AUXILIARY SYSTEMS	1169	JP-4	6 GALS./YR.	FPTA → FPTA/DPDO
JET ENGINE TEST CELL	1604	OIL	275 GALS./YR.	FPTA → BOILER/DPDO
384 ORGANIZATIONAL MAINTENANCE SQUADRON				
NON POWERED AGE	1108	PD 680	70 GALS./YR.	FPTA → DPDO
		JP-4	750 GALS./YR.	FPTA → FPTA/DPDO

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

DPDO: DEFENSE PROPERTY DISPOSAL OFFICE

FPTA: FIRE PROTECTION TRAINING AREA

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
TANKER INSPECTION (AIRCRAFT WASHRACK)	1108	PD-680	7,200 GALS./YR.	OIL/WATER INTERCEPTOR TO STORM SEWER
384 COMBAT SUPPORT GROUP				
AUTO HOBBY SHOP	16	OIL	4,000 GALS./YR.	FPTA → DPDO
GRAPHICS SHOP AND PHOTO LABORATORY	1120	DEVELOPER	400 GALS./YR.	SANITARY SEWER
		FIXER	400 GALS./YR.	SANITARY SEWER → SILVER RECOVERY TO SANITARY SEWER
SMALL ARMS RANGE	1541	PD-680	15 GALS./YR.	LANDFILL → DPDO
384 CIVIL ENGINEERING SQUADRON				
ENTOMOLOGY	1313	WASTE PESTICIDES	2 GALS./YR.	RINSATE DISCHARGED TO GRADE
EXTERIOR ELECTRIC	1210	PCB'S	1 TRANSFORMER/YR.	DPDO
GOLF COURSE MAINTENANCE	1313	OIL	12 GALS./YR.	FPTA → DPDO

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

FPTA: FIRE PROTECTION TRAINING AREA

DPDO: DEFENSE PROPERTY DISPOSAL OFFICE

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
LIQUID FUELS MAINTENANCE	990	SPENT FILTERS	60 FILTERS/YR.	WEATHERED TO ON-BASE LANDFILL → WEATHERED TO OFF-BASE LANDFILL
		SLUDGE	5 GALS./YR.	WEATHERED AND BURIED
PAINT SHOP	691	PAINT THINNERS (BEFORE 1983)	260 GALS./YR.	FPTA
		PAINT THINNERS (AFTER 1983)	10 GALS./YR.	DPDO
USAF HOSPITAL McCONNELL				
DENTAL X-RAY	806/212	FIXER	52 GALS./YR.	SANITARY SEWER → SILVER RECOVERY TO SANITARY SEWER
		DEVELOPER	52 GALS./YR.	SANITARY SEWER
RADIOLOGY	212	FIXER SYSTEM CLEANER	3 GALS./YR.	SANITARY SEWER
		DEVELOPER SYSTEM CLEANER	3 GALS./YR.	SANITARY SEWER
		FIXER	600 GALS./YR.	SANITARY SEWER → SILVER RECOVERY TO SANITARY SEWER
		DEVELOPER	360 GALS./YR.	SANITARY SEWER
184 CIVIL ENGINEERING FLIGHT SQUADRON				
MECHANICAL SHOP	15	OIL	144 GALS./YR.	FPTA → DPDO

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

FPTA: FIRE PROTECTION TRAINING AREA

DPDO: DEFENSE PROPERTY DISPOSAL OFFICE

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
184 RESOURCE MANAGEMENT SQUADRON				
MOTOR POOL	43	PD-680	600 GALS./YR.	FPTA (estimated) → BOILER/DPDO (confirmed)
		OIL	1,200 GALS./YR.	FPTA (estimated) → BOILER/DPDO (confirmed)
184 COMBAT SUPPORT SQUADRON				
PHOTO LABORATORY	41	DEVELOPER	50 GALS./YR.	SANITARY SEWER (confirmed)
		FIXER	100 GALS./YR.	SANITARY SEWER (estimated) → SILVER RECOVERY TO SANITARY SEWER (confirmed)
184 CONSOLIDATED AIRCRAFT MAINTENANCE SQUADRON				
AEROSPACE GROUND EQUIPMENT	46	OIL	1,200 GALS./YR.	FPTA (estimated) → DPDO (confirmed)
		PD-680	180 GALS./YR.	FPTA (estimated) → DPDO (confirmed)
CORROSION CONTROL SHOP	39	LACQUER, THINNER, KETONE, POLYURETHANE PRIMER	65 GALS./YR.	FPTA (estimated) → DPDO (estimated)
JET ENGINE SHOP	37	PD-680	120 GALS./YR.	FPTA (estimated) → DPDO (confirmed)
		OIL	600 GALS./YR.	FPTA (estimated) → DPDO (confirmed)
		CARBON REMOVER	7 GALS./YR.	FPTA (estimated) → DPDO (confirmed)
FUEL SYSTEM REPAIR	1129	JP 4	600 GALS./YR.	FPTA (estimated)
		PD 680	60 GALS./YR.	FPTA (estimated) → BOILER/DPDO (estimated)

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

FPTA: FIRE PROTECTION TRAINING AREA

DPDO: DEFENSE PROPERTY DISPOSAL OFFICE

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
GUN SERVICES	49	PD-680	120 GALS./YR.	FPTA → DPDO
PHASE INSPECTION	41	PD-680	260 GALS./YR.	FPTA → DPDO
		HYDRAULIC FLUID	700 GALS./YR.	FPTA → DPDO
WEAPONS RELEASE	49	METHYL ETHYL KETONE	30 GALS./YR.	FPTA → DPDO
		PD 680	480 GALS./YR.	FPTA → DPDO
		METHYLENE CHLORIDE	12 GALS./YR.	DPDO
		OIL	520 GALS./YR.	FPTA → DPDO
		NAPTHA	130 GALS./YR.	FPTA → DPDO
		WASTE PAINT AEROSOL CANS	160 CANS/YR.	ON-BASE LANDFILLS → OFF-BASE LANDFILLS
WHEEL & TIRE SHOP	41	PD-680	680 GALS./YR.	FPTA → DPDO
		PAINT STRIPPER	660 GALS./YR.	FPTA → DPDO
HYDRAULICS SHOP	41	HYDRAULIC FLUID	240 GALS./YR.	FPTA → DPDO
		PD 680	900 GALS./YR.	FPTA → DPDO
		METHYL ETHYL KETONE	10 GALS./YR.	FPTA → DPDO

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

FPTA: FIRE PROTECTION TRAINING AREA

DPDO: DEFENSE PROPERTY DISPOSAL OFFICE

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
184 TACTICAL CLINIC				
DENTAL & MEDICAL X RAY	35	FIXER	10 GALS./YR.	SANITARY SEWER → SILVER RECOVERY/SANITARY SEWER
		DEVELOPER	10 GALS./YR.	SANITARY SEWER
DET. 3, 47 FLYING WING				
T 37 MAINTENANCE SECTION	1218	HYDRAULIC FLUID	6 GALS./YR.	FPTA → BOILER/DPDO → DPDO
		OIL	6 GALS./YR.	FPTA → BOILER/DPDO
DET. 6, 37 AIR RESCUE RECOVERY SQUADRON				
HELICOPTER MAINTENANCE	1218	PD 680	260 GALS./YR.	FPTA → DPDO
		SYNTHETIC OIL	360 GALS./YR.	FPTA → BOILER/DPDO → DPDO
		HYDRUALIC FLUID	15 GALS./YR.	FPTA → BOILER/DPDO → DPDO
		FUEL	480 GALS./YR.	FPTA → DPDO OR FPTA

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

FPTA: FIRE PROTECTION TRAINING AREA

DPDO: DEFENSE PROPERTY DISPOSAL OFFICE

TABLE 4.1 (CONT'D)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 1960 1970 1980)
SMOKY HILL WEAPONS RANGE				
MOTOR POOL	6002	PD-680	60 GALS./YR.	HEADQUARTER'S LANDFILL AT SMOKY HILL → DPDO
		WASTE OIL	200 GALS./YR.	HEADQUARTER'S LANDFILL AT SMOKY HILL → DPDO
		ETHYLENE GLYCOL	60 GALS./YR.	HEADQUARTER'S LANDFILL AT SMOKY HILL → DPDO
		HYDRAULIC FLUID	30 GALS./YR.	HEADQUARTER'S LANDFILL AT SMOKY HILL → DPDO
HEAVY EQUIPMENT MAINTENANCE	6002	PD-680	100 GALS./YR.	HEADQUARTER'S LANDFILL AT SMOKY HILL → DPDO
		WASTE OIL	350 GALS./YR.	HEADQUARTER'S LANDFILL AT SMOKY HILL → DPDO
		HYDRAULIC FLUID	75 GALS./YR.	HEADQUARTER'S LANDFILL AT SMOKY HILL → DPDO

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

FPTA: FIRE PROTECTION TRAINING AREA

DPDO: DEFENSE PROPERTY DISPOSAL OFFICE

- 384 Combat Support Group
- 384 Civil Engineering Squadron
- USAF Hospital McConnell
- 184 Civil Engineering Squadron
- 184 Consolidated Aircraft Maintenance Squadron
- 184 Combat Support Squadron
- 184 Resource Management Squadron
- 184 Tactical Clinic
- Det 3, 47th Flying Wing
- Det 6, 37th Air Rescue Recovery Squadron
- Smoky Hill Weapons Range

Most shops were established in 1954-1956, as the base first began operations, and are still in their original locations, although in many cases significant expansion has occurred. Hazardous waste generation and disposal practices for the base from its onset to the mid-sixties are not well documented. Interviews with several civilian and military personnel who had been at the base during this period were performed and this information was used in developing the time lines in Table 4.1.

The wastes of concern to this report generated in the shops at McConnell AFB consist primarily of contaminated jet fuels, waste oils, acidic cleaning solutions, solvents and paint strippers.

Jet fuels such as JP-4 have been used in many of the flightline and maintenance shops. A majority of this fuel is recycled and reused on the base. Reusable fuel was collected in bowsers at various locations along the flightline. Contaminated fuel was collected in waste barrels or washed in the oil/water separators and later collected. Prior to 1972 most JP-4 fuels and other flammable materials were burned at various fire protection training areas. Other liquid wastes have been discharged to oil water separators, sanitary sewers or storm sewers. Substantial volumes of wastes were disposed of at onsite landfills until about 1972. After 1972, off-site commercial and municipal landfills were used to dispose of waste generated on-base. The DPDO has been involved in the sale of many waste liquids to off-base contractors.

Waste acid and alkaline solutions have generally been disposed of by neutralization with subsequent dilution to the sanitary sewer system.

Liquid solvents and paint stripper are typically disposed of by collection in waste barrels with subsequent removal by an off-base contractor. These wastes were also used as fuel in the FPTA from 1954 until 1972.

The Missile Maintenance Squadron has several shops in building 1107. Waste generated in these shops has been handled differently than other wastes at the base. Because of the possibility of missile fuel contamination of wastewater discharged from this area, all drains have been connected to holding (dump) tanks. These tanks are sampled by BES and analyzed for hydrazine and pH. If no contamination is found, the wastewater was discharged to the sanitary sewer. If there is hydrazine or oxidizer contamination, the water is treated by either chlorine, or caustic (respectively) before discharge.

Energy Recovery

Waste oils, JP-4 and other waste petroleum products with high heat value are burned in the heat plant boiler that uses natural gas as a primary fuel. The waste fuel boiler was constructed in 1972 to re-use the waste oils and fuels which accumulate at McConnell AFB. Its primary fuel is natural gas supplemented by about 10,000 gallons per year of waste oil and JP-4. The unit is located in Building 1106. A tank is used to collect waste materials for burning and a mechanism blends waste fuels in with the natural gas for burning. The unit is operated in the winter and supplies heat to many of the flight line shops. The unit has been tested periodically to determine any potentially harmful emissions. It was reported that all state and federal requirements have been met.

Material Storage Areas

Wastes generated from the shops have been accumulated at various locations on the base. Typically, shops took their wastes to various designated areas that have changed through the years. Drums or tanks were kept at these storage areas for accumulation of wastes. Listed in Table 4.2 is the location of present day waste accumulation and storage areas. Also included in Table 4.2 are the wastes typically handled at these sites. Inspection of several of these areas showed that drums were well secured and evidence of leakage was minimal.

The Defense Property Disposal Office (DPDO), has coordinated disposal of all drummed material at the base. Waste oils and synthetic lubricants are accumulated in tanks at central locations on the base or

TABLE 4.2
MAJOR WASTE ACCUMULATION AND STORAGE AREAS

Location	Material	Containers
Bldg. #45	Waste Petroleum Products*[1]	Drums
Bldg. #701	Waste Fuel Storage	Drums
Bldg. #1174	Waste Fuel Storage	Drums
Bldg. #1169	Scrap paints, thinners, etc.	Drums
Bldg. #1108	Waste Petroleum Products *[1]	Drums
Bldg. #710	Waste Petroleum Products *[1]	Drums
Bldg. #1349	Various RCRA hazardous Wastes (Interim Status Facility)	Drums
Bldg. #39	PD-680, Paints, etc.	Drums
Bldg. #16	Lube oils, Antifreeze	Drums

*[1] MOGAS, JP-4, Lube Oil, Motor oil

Source: McConnell AFB records

drummed and transferred to the DPDO storage area. Off base contractors are contracted to pump out the storage tanks and to pick up the drums for disposal. Hazardous solvents and chemicals not intended for re-use or sale are stored in drums in a recently constructed Hazardous Waste Storage facility (Building 1349). The facility is fully enclosed, has a concrete floor and is curbed to contain spills. A PCB storage area which meets regulatory requirements is also located at this site.

Fuels Management

The McConnell AFB fuels management system includes the storage and transport of substantial quantities of jet fuel and smaller quantities of AVGAS, diesel fuel and motor vehicle fuel (MOGAS). This system consists of over 100 tanks for storage of various fuels and other needs. A complete listing of storage tanks and their location, capacities and contents are identified in Table D.2 (Appendix D).

From 1953 to 1959, all fuels were delivered to the base by rail cars or tank trucks. In 1959 an underground fuel pipeline was put in service to bring in fuels from an off-base supplier. Since that time, 75% of the jet fuel has been delivered to the base by this pipeline, with the remainder being delivered by rail or tank truck. Other fuels have continued to be delivered by rail or tank truck.

Jet fuels are stored in one of three bulk storage tanks located by the north end of the flight line apron by Building 954. The fuel is transferred from the tanks to the flight line storage tanks by way of an underground pipeline. There are six pump stations used to transfer fuel from these smaller tanks into an underground hydrant system that supply aircraft on the flight line. All underground lines and tanks currently use cathodic protection to reduce corrosion.

The fuel tanks are cleaned every 5-8 years. From 1955-1960, AVGAS was stored in one of the bulk storage tanks and several of the flight-line tanks. After 1960, AVGAS usage was significantly reduced. The sludge removed from these bulk storage tanks has traditionally been small. Before 1970, these sludges (estimated 50 gallons per cleaning) were placed in dumpsters for disposal at the on-base landfill or weathered beside the tanks, within the dikes. Since about 1970, the sludge has been drummed and placed in dumpsters for off-base disposal. In the early 60's, a large amount of sludge was found in the tanks possibly

entering from the off-base pipeline. The sludge (estimated 30 cubic yards total) was taken to Landfill No. 1 for disposal.

Prior to about 1970, used fuel filters were collected and taken to special burn pits at one of the two base landfills. Since 1970, they have been disposed of off-base via DPDO.

Spills and Leaks

Several spills and leaks of fuel were confirmed by interviews with base personnel. The locations of these sites are shown in Figure 4.1.

Spill Site No. 1

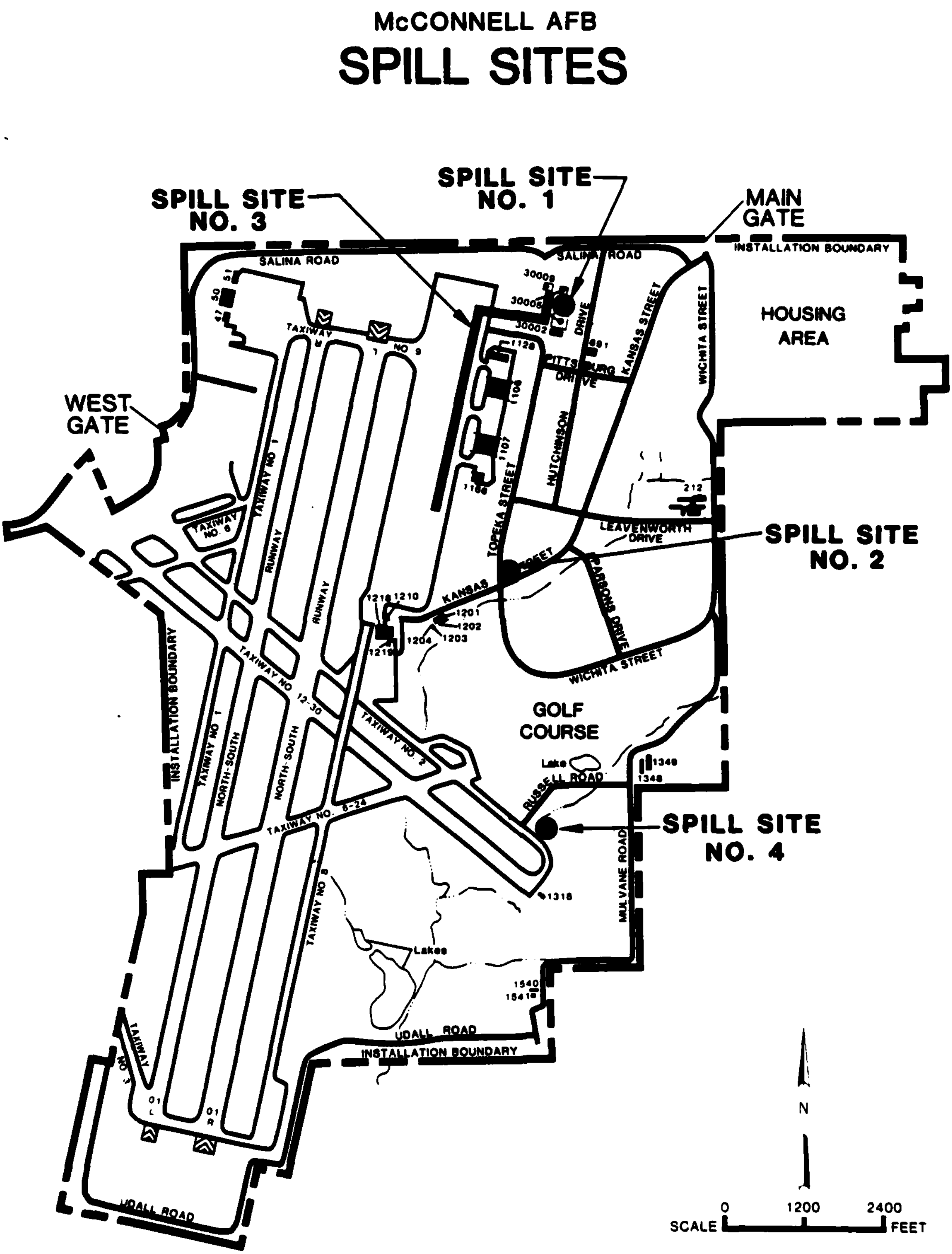
The bulk storage facility (30005 complex) has experienced two fuel spills. The first in the 1950's was due to a faulty float valve and an estimated 2,000 to 5,000 gallons of AVGAS was lost within the diked area. In 1982, the drain valve on a JP-4 bulk storage tank was left open, and approximately 15,000 gallons of fuel was spilled into the diked area. Some recovery was accomplished, but an estimated 11,000 gallons of fuel was lost due to perculation and/or evaporation. This site is identified as Spill Site No. 1.

Spill Site No. 2

A MOGAS leak occurred in early 1985 at the base service station. Fuel was discovered seeping through the asphalt drive. The leak was confirmed by a review of inventory records that showed significant losses. An estimated 3,000 gallons of MOGAS was lost on site. The leak was due to a hole in a transfer line between the storage tank and the dispensing pumps. No significant recovery of the fuel was made. This site is identified as Spill Site No. 2.

Spill Site No. 3

The eight inch underground pipeline between the bulk fuel tanks and the flight line did not have adequate corrosion protection and was replaced in 1963 due to "excessive maintenance problems" with leaks. Several leaks were discovered in this pipeline when fuel saturated the surrounding soil and began ponding at the surface. It is estimated that between 5,000 - 10,000 gallons of JP-4 was lost before the pipeline was replaced. Since replacement, no leaks have been reported. This site is identified as Spill Site No. 3.



SOURCE: INSTALLATION DOCUMENTS

Other Small Spills

A small (<5 gal) PCB spill occurred in Building 1 in May 1984 from a transformer. The spill was totally contained within that building by a concrete floor. The transformer and the drums containing the PCB residue from cleanup were transferred to DPDO for disposal. No adverse environmental impact resulted from this PCB spill.

Numerous small spills of fuel and oil were confirmed by base records and interviews with base personnel. These spills occurred onto paved areas or inside shop areas and were contained with adsorbent materials or washed into the drainage system to an oil-water separator. As a result, no potential for environmental contamination is associated with these small spills.

Pesticide Utilization

Pest management has been conducted at McConnell AFB by the Civil Engineering Squadron since the base was constructed. Both insecticide and herbicide application has been performed by the Entomology Shop. The pest management program has entailed both routine and specific [illegible] order chemical application and spraying. Pesticides have been stored [illegible] a locked and covered area of the Entomology Shop in Building [illegible] since 1980. Prior to that time the Entomology Shop was housed [illegible] the [illegible] Civil Engineering Shop area. Table D.1 in Appendix [illegible] includes a [illegible] pest control agents currently in use or stored at the base.

The procedure for the disposal of pesticide containers has been [illegible] triple rinse, puncture and landfill. In the past, rinsewater [illegible] sprayers was either reused, or sent to the sanitary sewer. [illegible] cedure was used until late 1982, when two [illegible] rinsewater [illegible] tanks (approximately 250 gallons each) were [illegible] 1313. This rinsewater is currently reused [illegible] spraying.

These rinsewater holding tanks were [illegible] grade with the opening slightly above grade and [illegible]. [illegible] caused several tank overflows [illegible] gradient of the tanks. The plume of contamination [illegible] this site since no vegetation grows at this [illegible]. [illegible] less than 100 gallons actually were released [illegible]. The tanks were provided with covers [illegible] 1984 and [illegible]

corrected. The spill from the rinsewater tanks (Figure 4.1) is Spill Site No. 4.

Another pesticide disposal site was used in the middle 1970's. From 1973-1977 mobile tanks were "sprayed out" at the end of the southwest runway area. An estimated total of 5 gallons of one percent chlordane and/or one percent malathion was disposed of in this area. Because of the small quantities involved, no potential for environmental contamination is expected to result from the use of this pesticides disposal area at McConnell.

<u>Fire Protection Training Areas</u>

The fire department at McConnell AFB has operated 5 separate fire protection training areas (FPTA) during the period of operation of the base. The location of these 5 areas is given in Figure 4.2. Each site is described in the following discussion.

<u>Fire Protection Training Area (FPTA No. 1)</u>

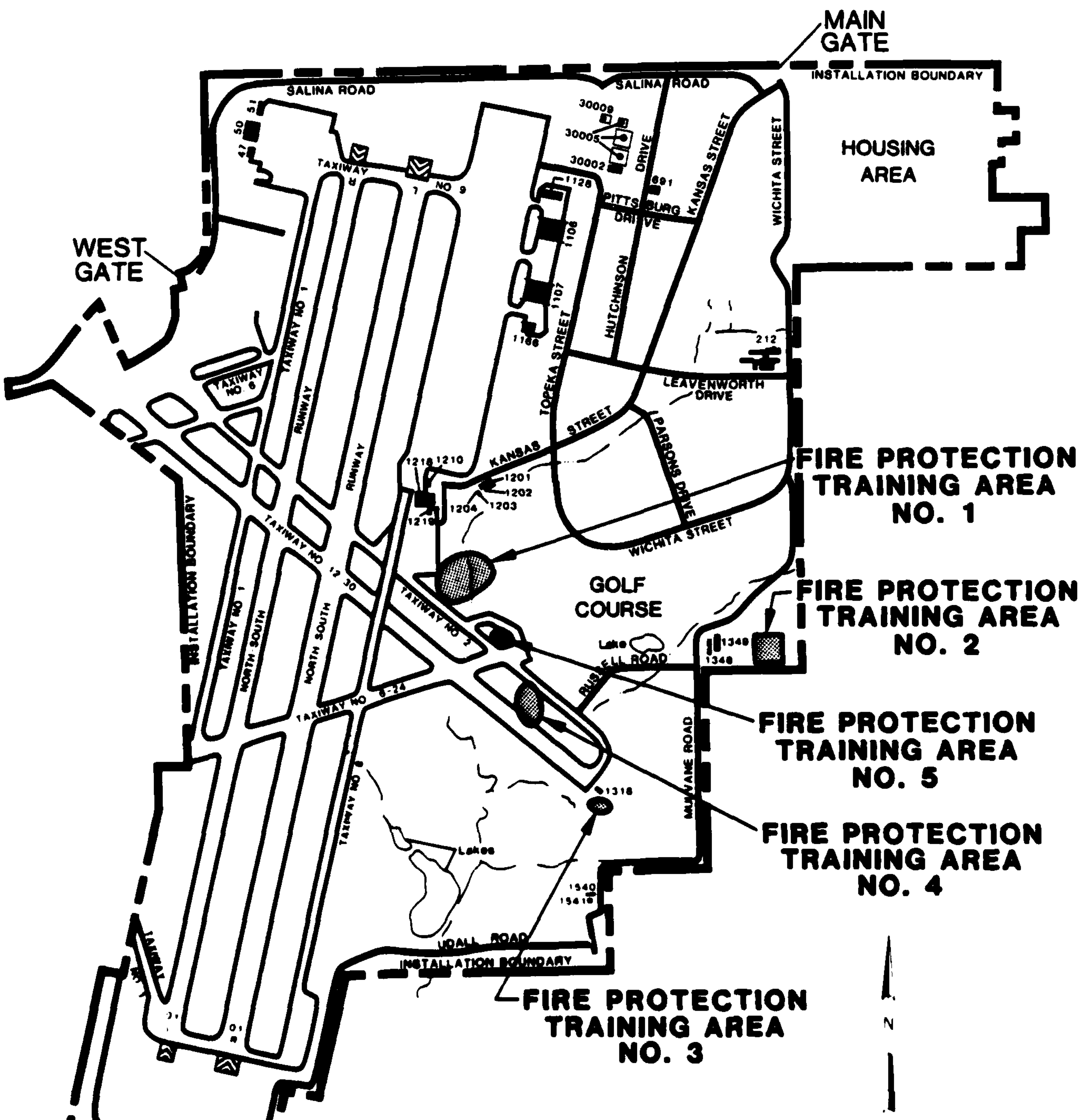
The first FPTA area at McConnell AFB was located southeast of Building 1218 and was used from 1954 to 1957. This site received intensive use for approximately three years. The fires were fueled using JP-4, MOGAS, AVGAS, thinners and other waste flammables. Water was the primary agent used to extinguish the fires although some protein foam and CO_2 was also used. The liquids were poured into shallow trenches that criss-crossed the site and ignited. A small (18") dike was constructed around the periphery of the area (approximately 50'-100' in diameter). The ground was not pre-wet before igniting the fires, however, large amounts of water were used to extinguish the flames. Training exercises were conducted on approximately a weekly basis. A typical training exercise would consist of several fires being ignited and doused over the course of a day, consuming about 25 fifty-five gallon drums of flammable liquids.

<u>Fire Protection Training Area (FPTA No. 2)</u>

In 1958 the FPTA was relocated to the area south of the current golf course driving range. Fire protection training exercises took place for approximately 4 years at [illegible]. In addition to the typical materials used at FPTA No. 1, clean JP-4 was also used at FPTA No. 2 for fueling fires, since the demand for [illegible] materials was great and JP-4 was relatively inexpensive. [illegible] were also constructed

McCONNELL AFB

FIRE PROTECTION TRAINING AREA SITES



SOURCE: INSTALLATION DOCUMENTS

at this site to contain fuel. A dike was also constructed around the perimeter of the training area (approx. 50-100' in diameter). This site also was subject to weekly use with several fires being ignited and doused with water, CO_2 or protein form in a typical day. No pre-wetting of the ground was practiced before igniting fires. Approximately 1,500 gallons of liquids were consumed in a typical training session. A mock-up plane was used at the site for fire training simulation.

Fire Protection Training Area (FPTA No. 3)

FPTA No. 3 was located south of Building 1318 and operated from 1963 to 1971. This site was used on a weekly basis for approximately 8 years. Two "pits" were constructed adjacent to one another with a small (18") dike surrounding each site. Fuels including JP-4, MOGAS, diesel, waste oil, scrap thinners and paints and possibly fuel sludges, were burned at this site. Several fires were ignited for each training session and extinguished with protein foam, CO_2 or water. Between 25 and 30 barrels of various fuels were used in a typical training session.

Fire Protection Training Area (FPTA No. 4)

FPTA No. 4 is located between the runways and was used as a temporary training site for fewer than six months in 1972 while FPTA No. 5 was being prepared for operation. The amount of flammable material used at this site was reported to be small, and due to the short duration of use, potential for environmental contamination at this site is minimal.

Fire Protection Training Area (FPTA No. 5)

The current FPTA has been in operation since 1972. The frequency of training was reduced to approximately 12 days per year and therefore this site has not received as intensive use as have previous FPTA's at McConnell AFB. Prewetting the training site previous to each use was instituted at this site in about 1972. Clean JP-4 (650 gallons/event) is currently used as the combustion agent although various other flammables have been used in the past. Since 1972, AFFF, Halon and other dry chemicals have been used to extinguish fires. The site has a mock aircraft for training purposes. Runoff is contained by a small dike and collected in an oil water separator. The site was operated unlined until very recently when a textile liner was installed (1984) to contain infiltration.

INSTALLATION WASTE DISPOSAL METHODS

The facilities at McConnell AFB, which have been used for the management and disposal of waste, can be categorized as follows:

- o Landfills
- o Hardfill Disposal Areas
- o Sanitary Sewage System
- o Surface, Drainage Systems
- o Explosive Ordnance Disposal Area
- o Incinerators

Landfills

Two landfills at McConnell AFB have been used for disposal of non-hazardous solid wastes and some industrial waste materials. The landfills are discussed in the following text and shown in Figure 4.3.

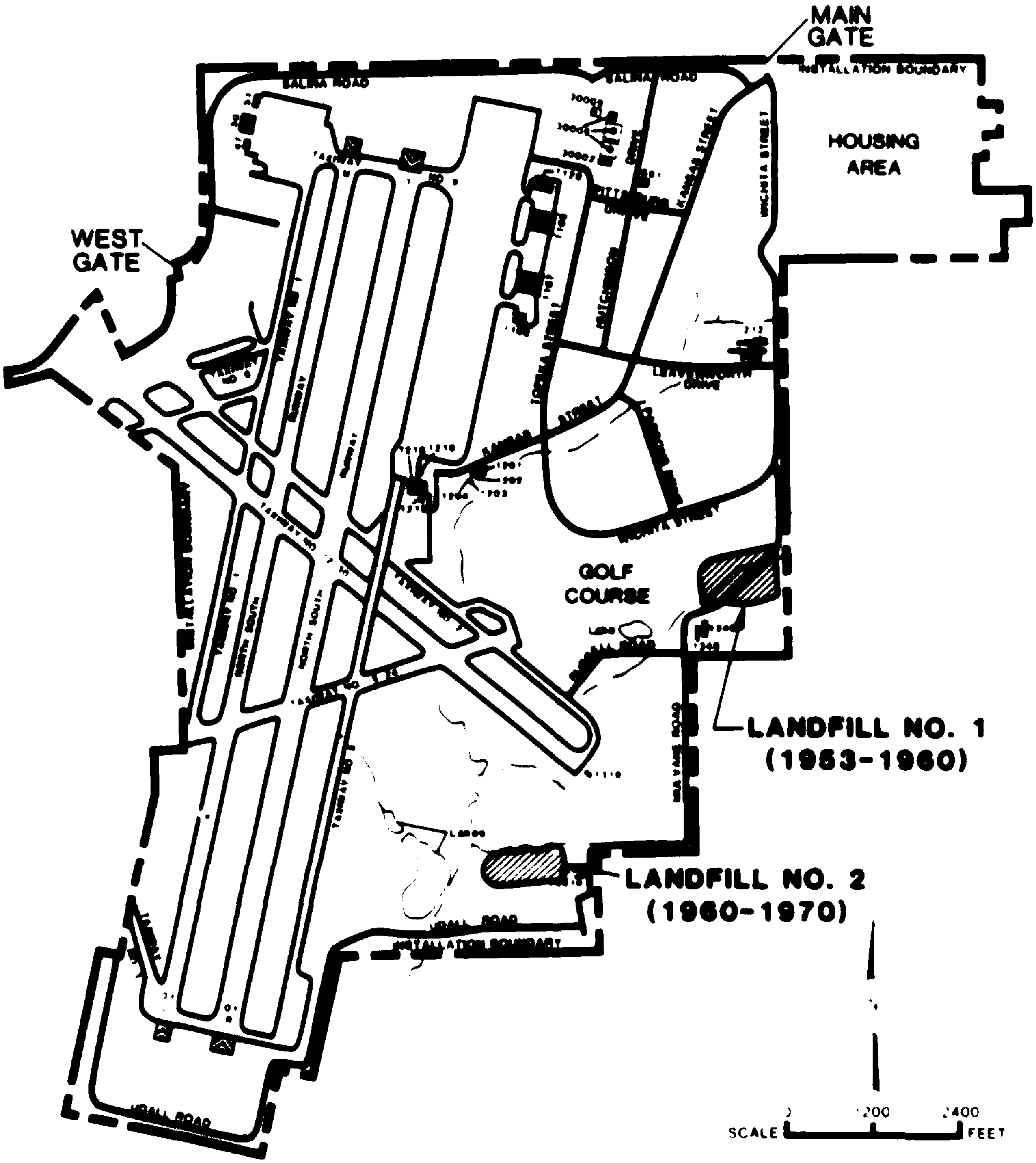
Landfill No. 1

Landfill No. 1 was operated from 1953 to 1960 and is located south and west of the golf course club house (see Figure 4.3). The landfill was operated as a trench and fill operation. The trenches were typically 10 to 15 feet deep and 12 to 15 feet wide of varing lengths. Wastes from the shops (including waste paint, empty pesticide cans and other fluids), demolition debris and refuse from base housing were hauled routinely to this landfill. Sludge and fuel filters from the bulk fuel tanks was also deposited in special pits in this landfill. The waste was frequently burned and a cover was (1-3 feet) added after burning. This site was closed in about 1960 with a soil and grass cover.

Landfill No. 2

Landfill No. 2 was operated from 1960 until about 1970 and is located adjacent to the small arms range by a small drainage creek and south of the explosive ordnance disposal area (see Figure 4.3). This landfill was a trench and fill operation similar to Landfill No.1. The trenches reached a maximum depth of 15 feet. Because of extensive filling, the resulting area is elevated approximately 20 feet above

McCONNELL AFB
LANDFILL SITES



SOURCE: INSTALLATION DOCUMENTS

natural grade. Wastes from shop dumpsters, household waste and general refuse were taken to this site and frequently burned. The site is closed with a soil cover and grass is growing on the site.

Hardfill Disposal Areas

There are several areas at McConnell AFB that have been used for disposal of construction rubble, brush and other hardfill. Hardfill areas that were identified by base personnel are presented in Figure 4.4. Based on interviews conducted with base personnel, review of file information and visual observations made during the site visit, there is no evidence of any hazardous waste disposal associated with these hardfill areas.

Hardfill No. 1 operated from about 1955 to 1965. This site is located on the southeastern end of the abandoned runway in an area now designated for mobility training. Hardfill No. 2 is located by Landfill No. 2 and has been in use from 1965 to present. Hardfill No. 3 is located on the eastern edge of the munitions storage area and was in use from about 1958 to 1962. Hardfill No. 4 is located east of the DPDO building, and was used from 1955 to 1965 for the disposal of scrapped aircraft wreckage.

Low-Level Radioactive Materials Disposal Site

A low level radioactive material disposal site is located west of Mulvane Road on the edge of the base golf course (Figure 4.5). The site was used from 1965 to 1968 for disposal of low-level radioactive electronic tubes and possibly other radioactive material. Accumulated wastes were encased in concrete and buried to a depth of 10-12 feet. Interviews with base personnel confirm the disposal of the material and an estimated volume of 12 drums of concrete encased material is buried on the 1/4 acre site. The site was visited in 1982 by personnel from the BES office and 384 AREFW Safety Division, and no elevated radioactivity levels were detected at the surface. As reported by interviewees, the area previously had a fence and warning signs around it. There is no evidence of the fence or burial site at the present-day site.

Sanitary Sewage System

Sanitary wastewater from the McConnell AFB is connected to the city of Wichita sewage treatment plant. The sanitary sewage collection

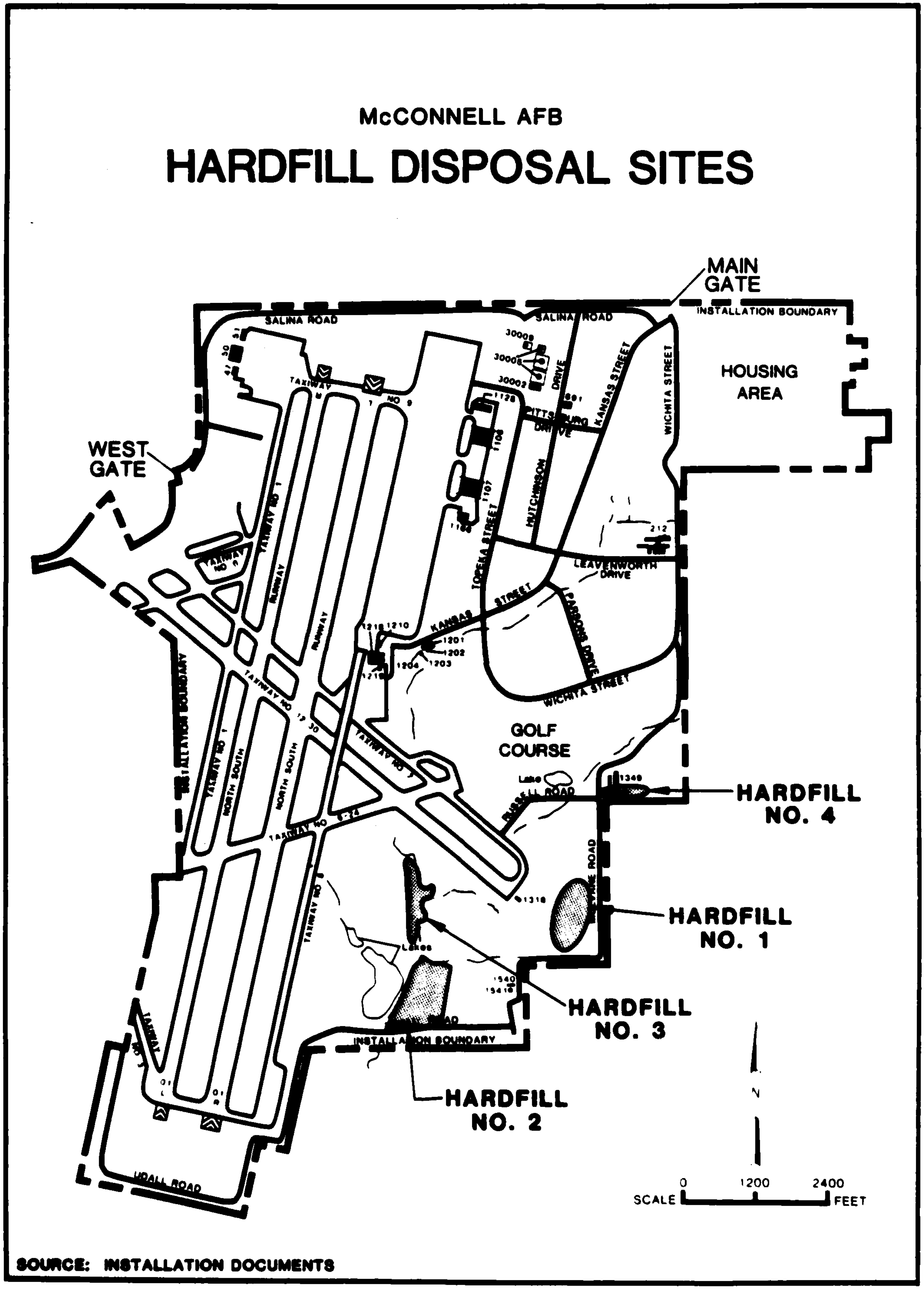
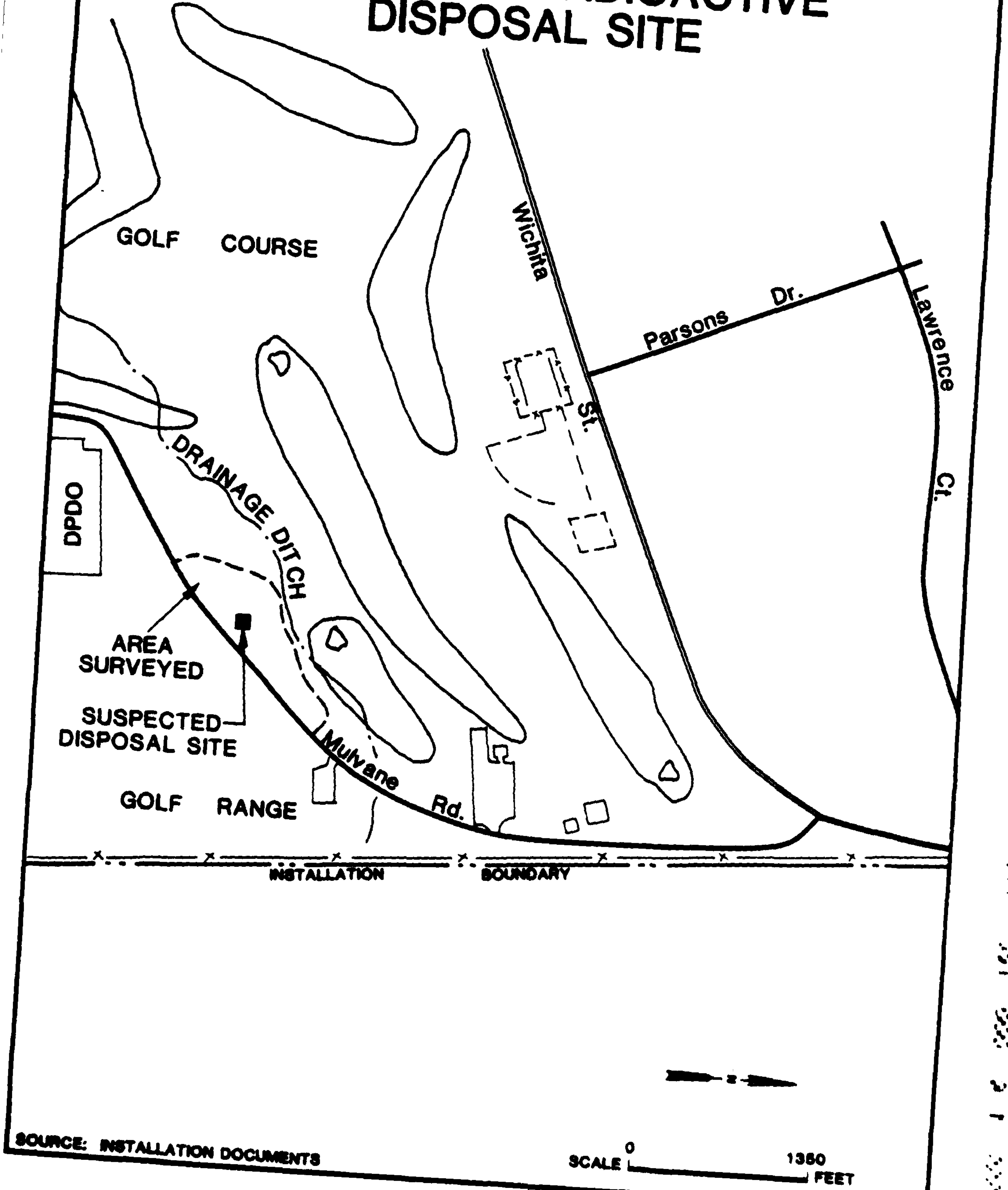

McCONNELL AFB
HARDFILL DISPOSAL SITES
MAIN GATE
INSTALLATION BOUNDARY
SALINA ROAD
HOUSING AREA
WICHITA STREET
KANSAS STREET
PITTSBURG DRIVE
HUTCHINSON DRIVE
TOPEKA STREET
LEAVENWORTH DRIVE
PARSONS DRIVE
WICHITA STREET
WEST GATE
GOLF COURSE
Lake
RUSSELL ROAD
HARDFILL NO. 4
HARDFILL NO. 1
HARDFILL NO. 3
HARDFILL NO. 2
Lakes
INSTALLATION BOUNDARY
UDALL ROAD
RUNWAY
NORTH SOUTH
TAXIWAY NO 1
TAXIWAY NO 6-24
TAXIWAY NO 7
N
SCALE 0 1200 2400 FEET
SOURCE: INSTALLATION DOCUMENTS

FIGURE 4.5

McCONNELL AFB
LOW-LEVEL RADIOACTIVE DISPOSAL SITE



SOURCE: INSTALLATION DOCUMENTS

system was constructed in 1954 and includes the flightline shops, housing and administration areas. The collection system has been expanded several times to service newly constructed areas.

Four areas on the base are served by individual septic tank/waste lagoon systems. These are located at the K-9 unit (Building 1358), the munitions storage area, the DPDO staging yard located at the southeast end of the abandoned runway, and the offices at the small arms range. The contents of the septic tanks are pumped out and the sludge from the tanks is disposed of off-base by outside contractors. No adverse environmental impact is expected from the operation of the sanitary sewer system or the four septic tank/waste lagoon systems.

There are 15 oil-water separators located on McConnell AFB (Table 4.3). They are sampled by the BES office and pumped out on an as needed basis. All units are located below ground and discharge to the sanitary sewer system. The oil-water separators present little potential for environmental contamination.

Explosive Ordnance Disposal Area

The Explosives Ordnance Disposal (EOD) area at McConnell AFB is located north of Landfill No. 2 (see Figure 4.6). The EOD area consists of a bunkered area for detonation. The area is used on a monthly basis for training and certification only. Typically a one pound block of C-4 is detonated and no significant residuals are left. All other EOD activities for McConnell occur at the Smoky Hill Weapons Range.

Incineration

Two incinerators have been operated at McConnell AFB. A pathological incinerator exists by the McConnell AFB Hospital but is no longer in operation. Its primary use was to dispose of hospital and vetinary wastes until it was closed in 1982. It was operated on an infrequent schedule. Currently all these wastes are sent to an off-site commercial incinerator. A classified waste incinerator currently operates at Building 739. It is used to burn documents containing classified material and is permitted by the state of Kansas. There is no indication that the operation of incinerators has created potential for groundwater contamination.

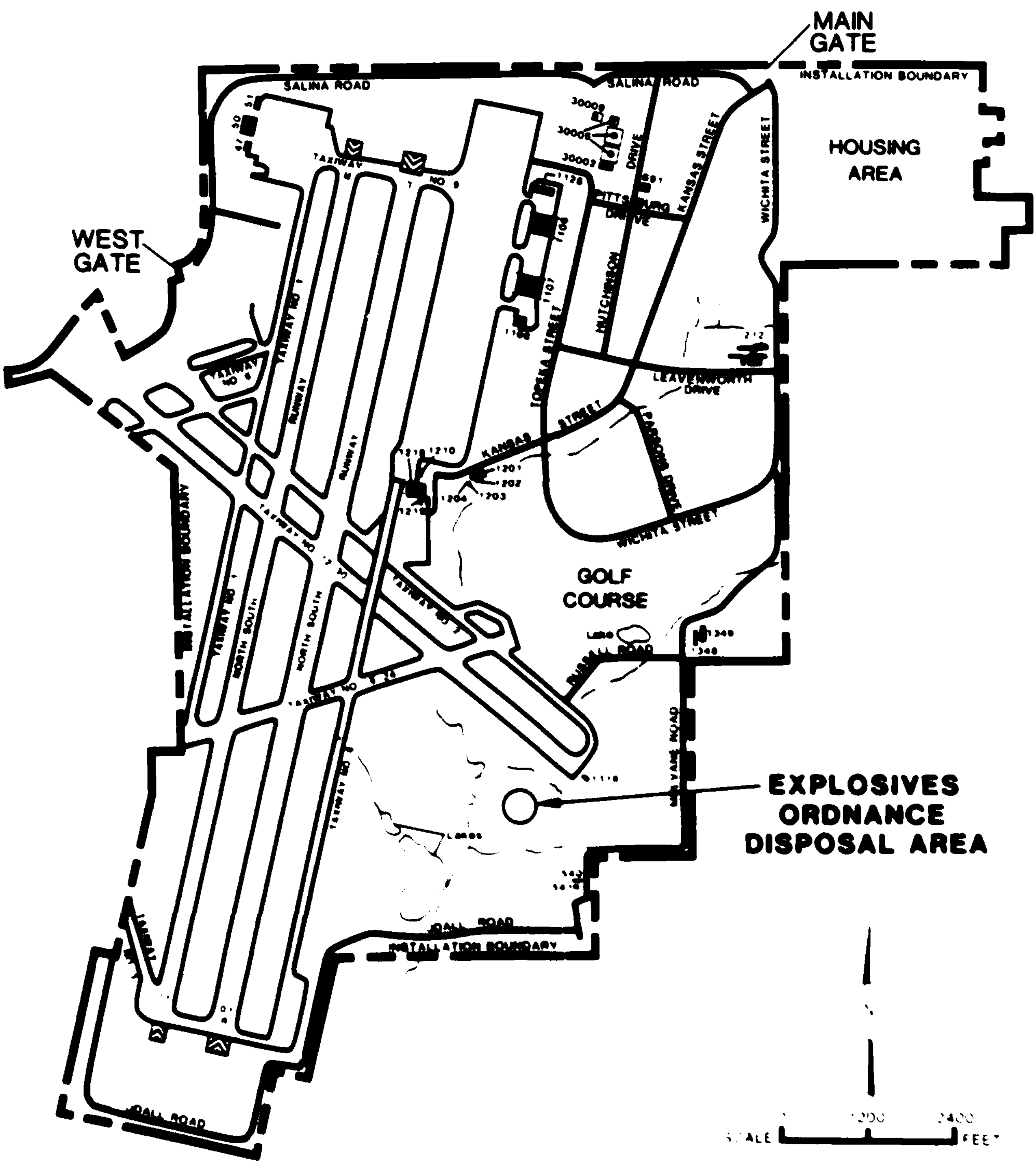
TABLE 4.3
OIL-WATER SEPARATORS

	Building	Shop	Discharge
1.	Bldg. 37 KANG	Jet Engine Shop	Sanitary Sewer
2.	Bldg. 1171	AGE Shop	Sanitary Sewer
3.	Bldg. 1169 FMS	Corrosion Control	Sanitary Sewer
4.	Bldg. 1128 KANG	Corrosion Control	Sanitary Sewer
5.	Bldg. 1107	MIMS HANGAR	Sanitary Sewer
6.	Bldg. 710	Motor Pool	Sanitary Sewer
7.	Bldg. 1166 KANG	Fuel Cell Repair	Sanitary Sewer
8.	Bldg. 16	Auto Hobby Shop	Sanitary Sewer
9.	Bldg. 692	Pavements/Grounds	Sanitary Sewer
10.	Bldg. 49 KANG	Weapons Control	Sanitary Sewer
11.	Bldg. 49 KANG	Gun Services	Sanitary Sewer
12.	Bldg. 41 KANG	Aircraft Maint. Hanger	Sanitary Sewer
13.	Bldg. 50 KANG	Aircraft Maint. Hanger	Sanitary Sewer
14.	Bldg. 50 KANG	Fuel Systems Maint-Hanger	Sanitary Sewer
15.	Bldg. 33 KANG	Vehicle Maint. Shop	Sanitary Sewer

Source: McConnell AFB records

McCONNELL AFB

EXPLOSIVES ORDNANCE DISPOSAL AREA



SOURCE: INSTALLATION DOCUMENTS

SATELLITE FACILITIES REVIEW

Two satellite facilities were reviewed for sites with evidence for environmental contamination. The Titan missile sites and the Smoky Hill Weapons Range. These facilities are discussed in the following sections.

Titan Missile Sites

McConnell AFB is the support base for nine active Titan II Intercontinental Ballistic Missile sites located in south Central Kansas. The missiles are under the operational command of the 381st Strategic Missile Wing (SMW). Interviews and site visits were used to determine if there was any sites with potential for environmental contamination. A helicopter overflight was performed so that each missile site could be viewed from the air. The Titan missile complexes consist of both aboveground and underground facilities. Fuels and chemicals which are potentially hazardous to the environment are present at each facility and are described in the following paragraphs.

Each Titan II missile is liquid fueled by a mixture of hydrazine and unsymmetrical dimethyl hydrazine (UDMH). The fuel mixes with an oxidizer, nitrogen tetroxide (N_2O_4) to produce the thrust. Each site contains 18,000 gallons of the hydrazine/UDMH mixture and 18,000 gallons of N_2O_4. In addition to this fuel, two diesel fuel service tanks (8,000 gallon underground and a 2,500 gallon tank in the missile silo) are present at each site. Sanitary sewage is treated at each complex with either septic tanks or lagoons and leach fields.

The missile complexes each have two additional underground tanks that are used as dump tanks for oxidizer and fuel. These tanks were designed to be used for emergency off-load of propellants, however they were never utilized. In the mid-1970's, the dump tanks were sealed and abandoned in place at all missile sites. Two large (100,000 gallon) water storage tanks are also located at each facility.

The bottom of the silo has a large W-shaped structure which is a part of the flame detector system. This structure retains any infiltrating ground water and also serves to contain all fuel leaks. These liquids are drained to the sump pit and pumped out of the silo to a ditch and evaporation pond located topside. This is a manual operation, not an automatic control. If any leakage of fuel, oxidizer, or oil

occurs, it is contained in the sump pit and neutralized or pumped out for disposal offsite. When the water in the sump is found to be contaminated, the Bio-Environmental Engineering Services (BES) office is contacted and the contamination is confirmed. The BES's representative determines if decontamination can be achieved and the liquid discharged, or whether a contractor must be utilized to pump the material into trenches for treatment. Occasionally, trace amounts of contaminants (fuels and oils) which have mixed with the infiltrating ground water have been pumped out to the discharge ditch and evaporation pond.

The nine inactive missile sites (2-1, 2-5, 2-7, 3-2, 3-4, 3-5, 3-6, 3-7, and 3-8) represent an ongoing program at McConnell AFB which is the result of a mission change for the base. All 18 missile complexes are scheduled to be deactivated by the end of 1986. A review of the deactivation procedures was made, and no potential for environmental contamination is expected to result from this deactivation.

Two spill incidents have been reported at the missile facilities, one at site 3-2 and one at site 3-7.

On 23 March 1983, a leak in the underground fuel oil transfer line at missile site 3-2 occurred. Fuel oil was being transferred from the 2,500 gallon tank within the silo to the 8,000 gallon storage tank located underground. Approximately 2,000 gallons of fuel oil was lost external to the silo, and therefore could not be collected underground, by the in-silo collection system. A pressure check of the transfer line confirmed a breach in the line and the line was abandoned in place. Monitoring of the potable water supply well at the facility and surface water bodies within one mile of the facility have not revealed any diesel fuel present. Some fuel oil has been infiltrating the silo sump pits since the accident, and is being emulsified prior to being discharged. The silo is located in a rural area where groundwater represents the only source of drinking water.

In August, 1978 approximately 13,800 gallons of oxidizer was spilled within the silo at site 3-7 due to an "O" ring becoming trapped in a disconnect fitting, preventing the closure of a shut off valve. About 80,000 gallons of water was added to the oxidizer resulting in an acid storm within the silo, producing a nitrogen dioxide cloud which spewed out of the silo and damaged vegetation 1/4 mile away. The liquid is a

weak nitric acid solution and was totally contained within the silo and was later pumped out by a private waste disposal contractor and neutralized. Disposal of the neutralized liquid occurred at the Furley Landfill, Furley, Kansas. Since the spill was totally contained within the silo no potential for environmental contamination is expected as a result of this incident.

Smoky Hill Weapons Range

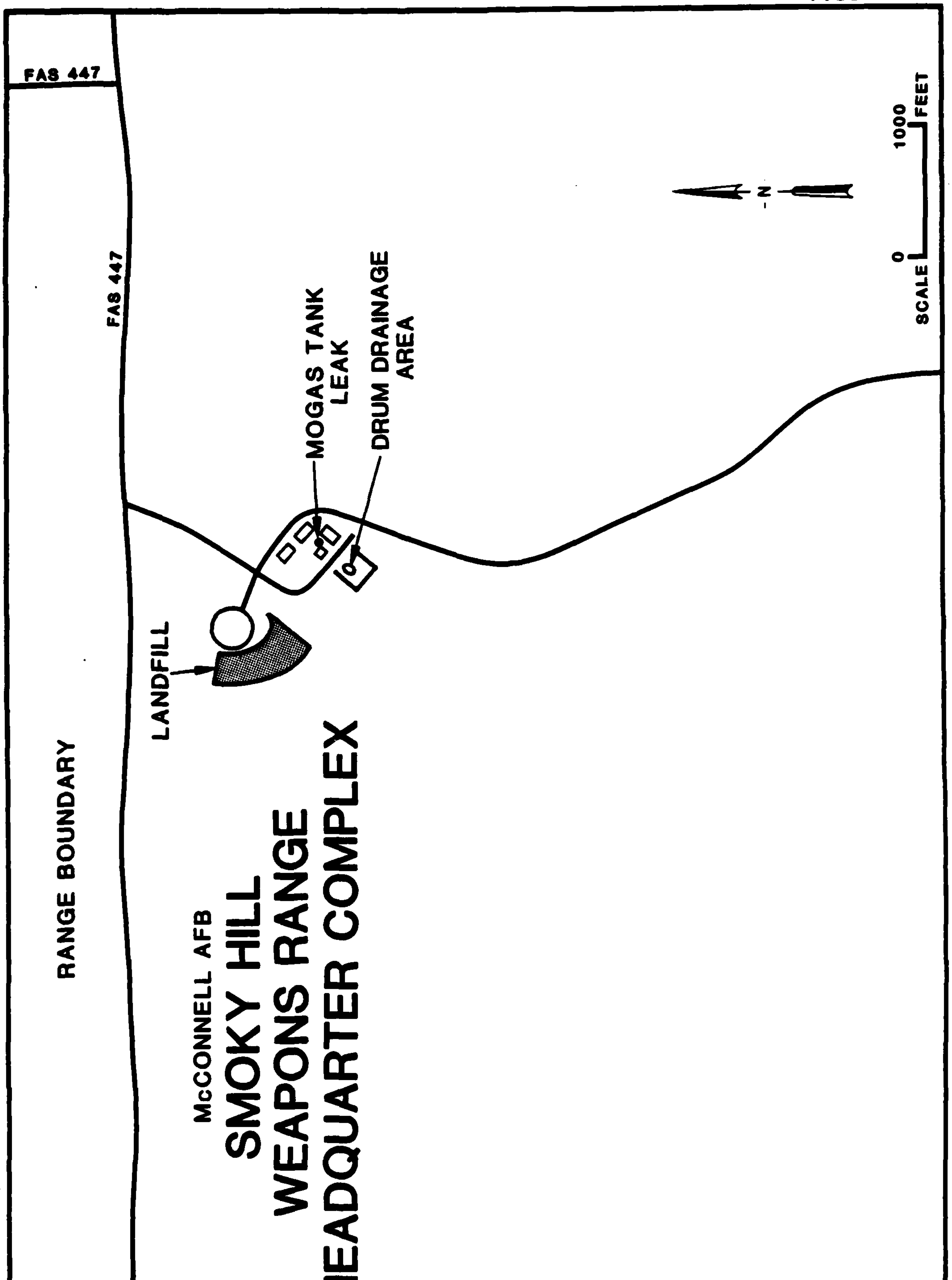
Smoky Hill Weapons Range was acquired by the U.S. Army in 1942 and operated as a gunnery range until it was assigned to the USAF in 1946. The Air Force operated Smoky Hill as a bombing range until October 1973 when the Kansas Air National Guard assumed range command jurisdiction and operational control. Real property accountability was transferred to the Kansas Air National Guard in October 1984.

Activities at the weapons range have remained relatively consistent throughout its history. The range consists of 33,873 acres, of which 26,696 acres are being used for agriculture leases, crop and grazing leases, and hay leases. The remaining 7,181 acres are target areas. Two types of weapons training occur at the range, strafing and bombing.

There are two complexes of industrial activity at Smoky Hill (see Figure 3.3). The operations center which is located in the heart of the target area, and the headquarters complex which is located on the north eastern edge of the range. A landfill was operated at the operations center from 1946 to 1983. Rubbish generated at the operations center was placed in a series of pits and burned prior to covering. These pits were approximately 30 ft x 20 ft x 15 ft deep and were operated for about 3 years each and then closed. Ash and residue are buried at this location. The landfill was closed in 1983 with a soil and grass cover. Due to the non-hazardous nature of the majority of this material (paper, wood, general office trash, and scrap metal) this site does not appear to present the potential for environmental contamination and has been dismissed from further consideration.

Shop activities including the motor pool and heavy equipment maintenance are located at the headquarters complex (Figure 4.7). Three areas of waste disposal and spills exist at this complex, a landfill, a drum drainage area, and a MOGAS tank rupture. The landfill received all waste generated at the headquarters complex and waste from the motor

FIGURE 4.7



McCONNELL AFB
SMOKY HILL
WEAPONS RANGE
HEADQUARTER COMPLEX
RANGE BOUNDARY
FAS 447
FAS 447
LANDFILL
MOGAS TANK
LEAK
DRUM DRAINAGE
AREA
N
SCALE
0
1000
FEET

pool, heavy equipment maintenance, and target maintenance shops. This landfill was operated from 1950 to 1983. Waste oils and solvents were reportedly disposed of in this landfill. The landfill was a trench and burn operation, and is estimated to contain 150,000 cu yds. of material. The landfill is closed and has a soil and grass cover.

The drum drain area is located approximately 100 yards southeast of the landfill. Empty drums are collected from McConnell AFB and various local sources and are placed in storage in this area. Holes are punched in the drums and the residual contents are allowed to drain onto the ground. The drained drums are then welded end to end and used as targets on the range. The area has been in use for 10 years and has processed about 2,000 drums during that time. Oil stains in the area are evident and are a minimum of 6 inches deep. The contents of the drums have varied through the years and have included de-icing fluids, and oils.

The third area of concern at the headquarters complex is a MOGAS underground tank which ruptured in 1983. This tank is located about 200 yards northwest of the landfill site and was replaced in 1983. During replacement, the soils around the tank (approximately 10 x 10 x 14) were observed to be saturated by gasoline. An estimated 1,000 to 2,000 gallons of MOGAS was lost in this tank failure.

Due to the close proximity of these three sites to one another they will be treated as one site, and will be referred to as the Smoky Hill Weapons Range (SHWR) Headquarters Disposal Site.

The Explosives Ordnance Disposal Area at Smoky Hill Weapons Range is located approximately 2 miles due east of the operations center and east of the main road through the weapons range. The EOD area consists of a depressed area surrounded by bunkers. The site has been used for the detonation of active explosives since 1978. Detonation residues (inert material) are disposed in a munitions residue landfill immediately adjacent to the EOD area. One pit is currently in use although other pits have been filled and covered. This EOD area serves both SHWR and McConnell AFB.

Prior to the activation of the present area, explosive ordnance disposal took place in an area approximately one mile east of the current area. This area was used since the 1950's, and was operated similar to the present day site.

Sanitary wastewater at Smoky Hill Weapons Range is handled by septic tanks and lagoons. The operations center and the headquarters complex are served by two individual systems. During the site visit, the interviewees did not report any operational problems and the potential for environmental contamination is minimal.

EVALUATION OF PAST DISPOSAL ACTIVITIES AND FACILITIES

Review of past waste generation and management practices at McConnell AFB has resulted in identification of 24 sites and/or activities which were considered as areas of concern for potential contamination and migration of contaminants.

Sites Eliminated from Further Evaluation

The sites of initial concern were evaluated using the Flow Chart presented in Figure 1.2. Sites not considered to have a potential for contamination were deleted from further evaluation. The sites which have potential for contamination and migration of contaminants were evaluated using the Hazard Assessment Rating Methodology (HARM). Table 4.4 summarizes the results of the flow chart logic for each of the areas of initial concern.

Eleven (11) of the 24 sites assessed did not warrant further evaluation. The rationale for omitting these sites from HARM evaluation is discussed below. These eleven sites include:

- Four hardfill areas
- Former missile site 3-7
- EOD Area McConnell
- EOD Area Smoky Hill Weapons Range
- Energy Recovery Boiler
- PCB Spill
- Fire Protection Training Area No. 4
- Operations Center Landfill - Smoky Hill Weapons Range
- Sanitary Sewer System

TABLE 4.4

SUMMARY OF FLOW CHART LOGIC FOR AREAS OF INITIAL HEALTH, WELFARE AND ENVIRONMENTAL CONCERN AT MCCONNELL AFB

Site	Potential Hazard to Health, Welfare or Environment	Need for Further IRP Evaluation Action	HARM Rating
Stormwater Drainage System	N	N	N
Sanitary Sewer System	N	N	N
Landfill No. 1	Y	Y	Y
Landfill No. 2	Y	Y	Y
Fire Protection Training Area No. 1	Y	Y	Y
Fire Protection Training Area No. 2	Y	Y	Y
Fire Protection Training Area No. 3	Y	Y	Y
Fire Protection Training Area No. 5	Y	Y	Y
Spill Site No. 1	Y	Y	Y
Spill Site No. 2	Y	Y	Y
Spill Site No. 3	Y	Y	Y
Spill Site No. 4	Y	Y	Y
Low-Level Radioactive Waste Disposal Site	Y	Y	Y
Missile Site 3-2	Y	Y	Y
Smoky Hill Weapons Range Headquarters Disposal Site	Y	Y	Y
SHWR - Operation Center Disposal Site	Y	N	N
Missile Site 3-7	Y	N	N
Oil Water Separators	N	N	N
Fire Protection Training Area No. 4	Y	N	N
PCB Spill	Y	N	N
McConnell EOD	Y	N	N
SHWR EOD	Y	N	N
Energy Recovery Boiler	Y	N	N
4 Hard Fill Areas	N	N	N

- Oil Water Separator
- Stormwater Drainage System

The four hardfill areas located on the base were used for disposal of construction rubble. No evidence of hazardous waste disposal was reported associated with any of the four sites.

Former missile site 3-7, the site of the 1978 oxidizer leak, has been completely inactivated. Cleanup activities have been completed and no evidence of environmental contamination resulting from the accident has been found. Base environmental data indicates that there is currently no potential hazard to health, welfare or environment. This site is not recommended for the IRP action.

The remaining missile sites, excluding site 3-2, present no current environmental threat. The deactivation program being carried out will remove the potential for these sites to become contaminant sources in the future. There have been incidents where minor discharges of fuel, oil, and cleaning fluids have occurred, but these quantities were very low and no significant contamiantion would be expected. Natural cleaning phenomena such as biodegradation would act on these low levels and prevent any accummulation of wastes.

The explosives ordnance area at McConnell AFB and the explosives ordnance disposal munitions landfills at Smoky Hill Weapons Range are not suspected of containing any hazardous materials wastes. Materials sent to these areas were in an inert form and pose no environmental threat.

The Energy Recovery Boiler has been tested on several occasions, and no ash or residue is generated by the unit. No adverse environmental impact should result from the continued operation of this unit.

The PCB spill which occurred in 1984 was contained on a concrete floor in Building 1. The spill was cleaned up, and the residue and contaminated materials have been drummed and sent to the PCB storage area. No environmental impact is expected to result from this spill.

Fire Protection Training Area No. 4 was operated as a temporary site only. The amount of flammable material utilized at this site combined with the short duration training that occurred result in minimal environmental impact from this site, and it was not recommended for

further IRP action. In addition, due to the proximity of this site to FPTA No. 5, residual contamination that may exist would be addressed under IRP actions recommended for FPTA No. 5.

The landfill located at the operations center of the Smoky Hill Weapons Range primarily received paper, wood, general office trash, and scrapmetal. This material is non-hazardous in nature, and no significant environmental impact should result from this landfill operation. Thus, this site was not recommended for further IRP action.

The sanitary sewer system, the stormwater drainage system and the oil water separators do not receive significant quantities of hazardous wastes and do not present a potential for environmental contamination.

Sites Evaluated Using HARM

The remaining 12 sites identified in Table 4.3 were evaluated using the Hazard Assessment Rating Methodology. The HARM process takes into account characteristics of potential receptors, waste characteristics, pathways for migration, and specific characteristics of the site related to waste management practices. Results of the HARM analysis for the sites are summarized in Table 4.5.

The procedures used in the HARM system are outlined in Appendix G and the specific rating forms for the 12 sites at McConnell AFB are presented in Appendix H. The HARM system is designed to indicate the relative need for follow on action. Photographs of these sites are included in Appendix F.

TABLE 4.5
SUMMARY OF HARM SCORES FOR
POTENTIAL CONTAMINATION SITES
AT MCCONNELL AFB

Rank	Site	Receptor Subscore	Waste Charac-teristics Subscore	Pathways Subscore	Waste Management Factor	HARM Score
1	Landfill No. 1	39	100	69	1.0	69
2	SHWR Headquarters Disposal Site	52	90	50	1.0	64
3	FPTA No. 2	37	90	61	1.0	63
4	FPTA No. 3	33	90	61	1.0	61
5	Landfill No. 2	35	80	69	1.0	60
6	Spill Site No. 3	39	80	61	1.0	60
7	FPTA No. 1 & No. 5	34	72	69	1.0	58
8	Spill Site No. 1	39	64	69	1.0	57
9	Low-Level Radioactive Waste	33	60	69	1.0	54
10	Spill Site No. 2	36	48	69	1.0	51
11	Missile Site 3-2	45	48	56	1.0	50
12	Spill Site No. 4	29	60	54	1.0	48

Source: Engineering-Science

SECTION 5

CONCLUSIONS

The goal of the IRP Phase I study is to identify sites where there is potential for environmental contamination resulting from past waste disposal practices and to assess the probability of contamination migration from these sites. The conclusions given below are based on field inspections; review of records and files; review of the environmental setting; interviews with base personnel, past employees and local, state and federal government employees; and assessments using the HARM system.

The HARM system takes into account factors such as site characteristics, waste characteristics, potential for contaminant migration and waste management practices. The HARM scores are designed to indicate the relative need for follow-up investigation. Details of the rating procedure are presented in Appendix G. Table 5.1 contains a list of the potential contamination sources identified at McConnell AFB and a summary of the HARM scores for those sites.

LANDFILL NO. 1

Landfill No. 1 operated from 1953 to 1960 and was the first landfill operated at the base. This landfill received waste during the activation period of the base as well as receiving POL tank sludge, paints and thinners. Open burning was done on a routine basis. The site contains an estimated 9,000,000 cubic feet of material. The site is closed with a soil and grass cover, and part of the base golf course is constructed over the site. The site is underlain by the Wellington Formation and is dissected by an ephemeral stream course that complicates the local hydrology. Soil layers have been disturbed by landfilling activities. This site represents a potential for environmental contamination and follow on investigation is warranted. This site received a HARM score of 69.

TABLE 5.1
SITES EVALUATED USING THE
HAZARD ASSESSMENT RATING METHODOLOGY
MCCONNELL AFB

Rank	Site	Operation Period	HARM Score(1)
1	Landfill No. 1	1953-1960	69
2	Smoky Hill Weapons Range Headquarters Disposal Site	1946-Present	64
3	Fire Protection Training Area No. 2	1958-1962	63
4	Fire Protection Training Area No. 3	1963-1971	61
5	Landfill No. 2	1960-1970	61
6	Spill Site No. 3	1954-1963	60
7	Fire Protection Training No. 1 & No. 5	1954-1957 No. 1 1972-Present No. 5	58
8	Spill Site No. 1	1982	57
9	Low-Level Radioactive Waste Disposal Area	1965-1968	54
10	Spill Site No. 2	1985	51
11	Missile Site 3-2	1983	50
12	Spill Site No. 4	1983	48

(1) This ranking was performed according to the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

SMOKY HILL WEAPONS RANGE HEADQUARTERS DISPOSAL SITE

This site has three components; a landfill, a drum drainage area, and a MOGAS tank rupture. The site has operated more or less continuously since 1946. The landfill operated from 1946 until 1983, and received all waste generated at the headquarters complex as well as the waste from the Motor Pool and the heavy equipment maintenance shops. The drum drainage area has operated since 1975, and has processed 1500-2000 drums during that time. Prior to use, all empty drums received for target manufacture are punctured and the residuals are allowed to drain to grade in this area. The final area comprising this site is the MOGAS tank rupture which occurred in 1983. An estimated 1000 to 2000 gallons of MOGAS were lost due to that rupture. The steel tank was replaced in kind, and no attempt to recover the fuel was made.

The soils at this site are typically thin sandy or thin clayey-silt soils underlain by a thick sandstone and shale bedrock. This site represents a potential for environmental contamination and follow-on investigation is warranted. The site received a HARM score of 64.

FIRE PROTECTION TRAINING AREA NO. 2

Fire Protection Training Area No. 2 represents a potential for environmental contamination and follow-on investigation is warranted. FPTA No. 2 was utilized from 1958 to 1962 and was located at the south end of the current golf course driving range. Flammable wastes generated on the base, MOGAS, AVGAS, paints, thinners, solvents, and JP-4 were utilized for fire training exercises. Clean (uncontaminated) JP-4 was used to supplement the primary source of flammable liquids when required. An estimated 300,000 gallons of flammable material were used at this site. The site is underlain by the Wellington Formation or a Loess and has low permeability clayey-silt soils reported to be up to 60" thick. The site received a HARM score of 63.

FIRE PROTECTION TRAINING AREA NO. 3

Fire Protection Training Area No. 3 represents a potential for environmental contamination and follow-on investigation is warranted. FPTA No. 3 was utilized from 1963 to 1971, and was located south of building 1318. Six hundred thousand gallons of flammable liquid waste

and clean JP-4 was consumed at this site. The site is underlain by the Wellington Formation or a Loess and has low permeability clayey-silt soils reported to be up to 60" thick. The site is adjacent to low lying areas with an ephemeral stream. The site received a HARM score of 61.

LANDFILL NO. 2

Landfill No. 2 was the last landfill operated at McConnell AFB. The landfill was operated from 1960 to 1970 and is located west of the small arms range and south of the EOD area. The landfill represents a potential for environmental contamination and follow-on investigation is warranted. The western face of the site is only partially covered, and drums as well as other items are protruding from the landfill. The landfill was a typical trench and fill operation, and open burning was a practiced method of volume reduction. The site is closed with a soil and grass cover. An estimated 4,500,000 cubic feet of material is contained in the site.

The soil layers at this site have been disturbed due to land-filling, and soils typical of this site are low permeability silty-clays of the area. The site is underlain by the Wellington Formation and is bordered on the north by an ephemeral stream. The site received a HARM score of 61.

SPILL SITE NO. 3

Spill site No. 3 represents a potential for environmental contamination and follow-on investigation is warranted. The underground pipe-line system which comprises Spill Site No. 3 connects the bulk fuel tanks to the flightline fuel storage and dispensing stations. This pipeline was put in service in 1954, and was replaced in 1963 due to excessive maintenance problems. Four major pipeline breaks have been reported along with other possible leaks and spills. The soils at this site are from the Tabler Complex, have low permeability and are under-lain by Loess and may have a perched water table 40"-60" below the surface. A HARM score of 60 was attributed to this site.

FIRE PROTECTION TRAINING AREAS NO. 1 AND NO. 5

Fire Protection Training Areas No. 1 and No. 5 are located adjacent to each other east of taxiway No. 2 and are treated as one site. FPTA No. 5, the area currently in use, is located between taxiway No. 2 and taxiway No. 4. FPTA No. 1 which operated from 1954 to 1957 was located immediately north of taxiway No. 4. This site represents a potential for environmental contamination and follow-on investigation is warranted. FPTA No. 1 utilized 225,000 gallons of flammable waste liquids. Only clean JP-4 has been used at FPTA No. 5 and an estimated 100,000 gallons has been utilized for training purposes since 1972 at this location. The soils are underlain by the Wellington Formation, and are characteristically a low permeability silty-clay. The site received a HARM score of 58.

SPILL SITE NO. 1

Spill site No.1 , the bulk fuel storage area, represents a potential for environmental contamination and follow-on investigation is warranted. In 1982 approximately 15,000 gallons of JP-4 were spilled within the diked area due to a drain valve on the storage tank being left in the open position. Some fuel recovery was attempted, but an estimated 11,000 gallons of JP-4 evaporated or perculated into the ground. Soil and geologic conditions at this spill site are similar to Spill Site No. 3, having low permeability soils and underlain by Loess. A HARM score of 57 was attributed to this site.

LOW-LEVEL RADIOACTIVE WASTE DISPOSAL AREA

The low-level radioactive waste disposal area represents a potential for environmental contamination and follow-on investigation is warranted. The site was used for disposal of low-level radioactive electronic tubes and possibly other low-level radioactive material. from 1965 to 1968. The waste material was encased in concrete prior to burial. The burial site encompasses approximately 1/4 acre and is located on the eastern edge of the base golf course in the same area as landfill No. 1. Base personnel estimate a maximum of twelve 55-gallon drums of low-level radioactive material are buried at this site. Site

and soil conditions at this site are similar to those attributed to Landfill No. 1. The site received a HARM score of 54.

SPILL SITE NO. 2

Spill site No. 2 is located at the base service station. A MOGAS transfer line ruptured in 1985 and an estimated 3000 gallons of MOGAS were lost underground. An attempt at fuel recovery was made, and less than 1,000 gallons of fuel was recovered. The site represents a potential for environmental contamination and follow-on investigation is warranted. The site is underlain by the Wellington Formation and soils are silty-clays or clays with characteristic low permeabilities. The site received a HARM score of 51.

MISSILE SITE 3-2

The underground fuel oil transfer line between the missile site and the underground storage tank ruptured in March 1983, and an estimated 2000 gallons of diesel fuel was lost. A pressure test on the transfer line confirmed the rupture and the line was abandoned in place. No attempt at fuel recovery was made. The soils at this site are clayey sediments and residuum underlain by a thick bed of shale and Cherty Limestone. The site represents a potential for environmental contamination and follow-on investigation is warranted. A HARM score of 50 was attributed to this site.

SPILL SITE NO. 4

Spill site No. 4 is located behind Bldg. No. 1313. The spill resulted from several overflows of pesticide rinsewater from holding tanks in 1983 and 1984, and an estimated quantity less than 100 gallons of diluted pesticide rinsate water was released. The site is easily identifiable due to its lack of vegetation. The site is underlain by the Wellington Formation and has silty-clay soils with low permeabilities. The site represents a potential for environmental contamination and follow on investigation is warranted. A HARM score of 48 was attriputed to this site.

SECTION 6

RECOMMENDATIONS

Twelve sites were identified at McConnell AFB as having the potential for environmental contamination. These sites have been evaluated and rated using the HARM system which assesses their relative potential for contamination and provides the basis for determining the need for additional Phase II IRP investigations. All of the twelve sites have sufficient potential to create environmental contamination and warrant Phase II investigations. The sites evaluated have been reviewed concerning land use restrictions which may be applicable.

RECOMMENDED PHASE II MONITORING

The subsequent recommendations are made to further assess the potential for environmental contamination from waste disposal areas at McConnell AFB. The recommended actions are sampling and monitoring programs to determine if contamination does exist at the site. If contamination is identified in this first-step investigation, the Phase II sampling program will probably need to be expanded to define the extent and type of contamination. The recommended monitoring program for Phase II is discussed first by general monitoring rational and then by site in the following subsections. The recommendations are summarized in Table 6.1 and 6.2.

Monitoring Rational

The hydrogeologic conditions present at each waste disposal facility are site-specific due to variations in geology, topography, land use modifications, etc. These conditions or man-made changes in the local environmental setting must be clearly understood in order to design an effective ground-water quality monitoring system. At present, the percise site-specific conditions existing at each McConnell AFB waste disposal or hazardous material management facilities are unknown. Soil

TABLE 6.1
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP
AT MCCONNELL AFB

Site	Rating Score	Recommended Monitoring	Sample Analyses	Comments
Landfill No. 1	69	Conduct Geophysical Survey. Install and sample two up-gradient and two downgradient wells.	List A, Metals (Cd,Cr,Fe,Mn, Ni,As,Hg,Zn)	If sampling indicates contamination continue monitoring. Monitoring wells and additional soil borings may be necessary to assess extent of contamination.
Smoky Hill Weapons Range Headquarters Disposal Site	64	Conduct core sampling to water table in Drum Drain Area. Use Organic Vapor Analysis (OVA) during boring. Collect soil samples at 2 ft intervals and at depths of high OVA readings.	List B	If sampling indicates contamination continue monitoring. Monitoring wells and additional soil borings may be necessary to assess extent of contamination.
		Conduct core sampling to water table in MOGAS Tank Rupture Area. Use OVA during boring. Collect soil samples at 5 ft intervals and at depths of high OVA readings.	List B	If sampling indicates contamination continue monitoring. Monitoring wells and additional soil borings may be necessary to assess extent of contamination.
		Conduct Geophysical Survey. Install and sample two up-gradient and three downgradient wells at landfill site.	List A	If sampling indicates contamination continue monitoring. Monitoring wells and additional soil borings may be necessary to assess extent of contamination.

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TABLE 6.1
(CONTINUED)
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP
AT MCCONNELL AFB

Site	Rating Score	Recommended Monitoring	Sample Analyses	Comments
Fire Protection Training Area No. 2	63	Conduct core sampling to water table. Use OVA during boring. Collect soil samples at 5 ft intervals and at depths of high OVA readings.	List B	If sampling indicates contamination continue monitoring. Monitoring wells and additional soil borings may be necessary to assess extent of contamination.
Fire Protection Training Area No. 3	61	Conduct core sampling to water table. Use OVA during boring. Collect soil samples at 5 ft and at depths of high OVA readings.	List B	If sampling indicates contamination continue monitoring. Monitoring wells and additional soil borings may be necessary to assess extent of contamination.
Landfill No. 2	61	Conduct geophysical survey. Install and sample two up-gradient and two downgradient wells.	List A, Metals (Cd,Cr,Fe,Mn, Ni,As,Hg,Zn)	If sampling indicates contamination continue monitoring. Monitoring wells and additional soil borings may be necessary to assess extent of contamination.

TABLE 6.1
(CONTINUED)
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP
AT MCCONNELL AFB

Site	Rating Score	Recommended Monitoring	Sample Analyses	Comments
Spill Site No. 3	60	Conduct geophysical surveys along pipeline corridor in unpaved areas where no utilities exist to identify potential areas of contamination. If interferences (pavement, utilities) cannot be overcome, conduct 10 foot sample at not less than 50' intervals along pipeline. Use OVA during borings, collect soil samples at 2 ft intervals and at depths of high OVA reading.	List B	If sampling indicates contamination continue monitoring. Monitoring wells and additional soil borings may be necessary to assess extent of contamination.
Fire Protection Training Area No. 1 & No. 5	58	Conduct core sampling to water table. Use OVA during boring. Collect soil samples at 5 ft intervals and at depths of high OVA readings.	List B	If sampling indicates contamination continue monitoring. Monitoring wells and additional soil borings may be necessary to assess extent of contamination.
Spill Site No. 1	57	Conduct core sampling to water table. Use OVA during boring. Collect soil samples at 5 ft intervals and at depths of high OVA readings.	List B	If sampling indicates contamination continue monitoring. Monitoring wells and additional soil borings may be necessary to assess extent of contamination.

TABLE 6.1
(CONTINUED)
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP
AT MCCONNELL AFB

Site	Rating Score	Recommended Monitoring	Sample Analyses	Comments
Low-Level Radioactive Waste Disposal Site	54	Sample wells at landfill No. 1 site.	Gross Alpha Gross Beta Total Radium	If sampling indicates contamination continue monitoring. Monitoring wells and additional soil borings may be necessary to assess extent of contamination.
Spill Site No. 2	51	Conduct core sampling to water table. Use OVA during boring. Collect soil samples at 2 ft intervals and at depths of high OVA readings. Install and sample one upgradient and two downgradient wells.	List B	If sampling indicates contamination continue monitoring. Monitoring wells and soil borings may be necessary to assess extent of contamination.
Missile Site 3-2	50	Conduct core sampling to water table. Use OVA during boring. Collect soil samples at depth indicated by site plan. Install and sample one upgradient and two downgradient wells.	Soil-Oil & grease Water-Oil & grease Volatile organics	If sampling indicates contamination continue monitoring. Monitoring wells and soil borings may be necessary to assess extent of contamination.

TABLE 6.1
(CONTINUED)
RECOMMENDED MONITORING PROGRAM FOR PHASE II IRP
AT MCCONNELL AFB

Site	Rating Score	Recommended Monitoring	Sample Analyses	Comments
Spill Site No. 4	48	Soil boring at 3 locations at suspected spill site. Collect soil samples at 1 foot intervals for first three feet, see comments.	Bromocil, HYVAR-XL and other pesticides and herbicides indicated by detail review of pesticide usage in 1983 and 1984	If sampling indicates contamination, continue soil boring to greater depths and increase number of boring sites to determine extent and severity of contamination. Contamination is not suspected to penetrate greater than a few feet due to low permeability of soils.

TABLE 6.2
RECOMMENDED LIST OF ANALYTICAL PARAMETERS FOR PHASE II IRP
AT McConnell AFB

LIST A

Oil and Grease
Volatile Organics (EPA Methods 601 & 602)
Phenolics
Lead

LIST B

Lead
Oil and Grease
Volatile Organics (EPA Methods 601 & 602)

Source: Engineering-Science

test borings and temporary observation wells may be employed to obtain site-specific information. A systematic, more efficient and cost-effective approach would be to utilize geophysical techniques to obtain local subsurface information. Electrical resistivity (ER) and electromagnetic conductivity (EMC) are geophysical instruments that employ indirect measurement technologies to collect data describing subsurface material electrical properties. The instruments respond to changes or contrasts in either the horizontal or vertical planes which may be correlated to direct sampling methods, such as test borings. If local geology permits both methods may be utilized in shallow situations (less than thirty feet deep) to determine stratigraphic changes, depth to ground water, aquifer thickness and contaminated zones if sufficient contrasts exists. ER may be employed in more complicated terrains or in situations where deep contamination is suspected. Wells may then be installed systematically, in zones selected by the geophysical techniques.

This geophysical approach to monitoring program design significantly reduces both costs and schedules. The use of geophysical techniques at waste disposal facilities has been well documented in the technical literatue. A USEPA guidance manual describes the capabilities and limitations of electrical resistivity at waste disposal facilities and is applicable to the probable conditions that may be encountered at McConnell AFB (Benson, et al., 1984 and USEPA, 1978). Other geophysical methodologies can be utilized for specialized purposes - for example, a metal detector may be used in shallow settings to locate buried ferrous materials and the magnetometer may be utilized to locate either buried objects or distrubed zones (backfilled trenches or pits) in shallow and deep settings.

Ground-water quality monitoring systems must be designed for the site-specific conditions existing at a waste disposal facility. Guidelines for well system design have been published in several USEPA reports. One report indicates that a few guidelines are applicable to conditions such as those noted at McConnell AFB. For large areas/landfills, or for areas for multiple ground-water flow directions, it is recommended that more than the usual four wells (one upgradient and three downgradient, from RCRA, Subpart F, Section 265.91, "Ground-Water Monitoring system") may be required. Where multiple flow directions may

exist beneath a site, geophysical methods should be utilized to guide well placement, both the physical location and the screened interval. In situations where the site is physically large or has an unusual geometry and therefore has a long downgradient dimension (the site border, which when sketched on a topographic map, appears to be drawn at a right angle to the principle direction of ground-water flow), the general rule is to install one monitoring well for each 250 feet of downgradient frontage (USEPA, 1980, page 41). This well spacing is considered to be a maximum allowable interval between wells, assuming that local hydrogeologic conditions are reasonably uniform. Wells must be installed at closer intervals if the site subsurface conditions are determined to be complex.

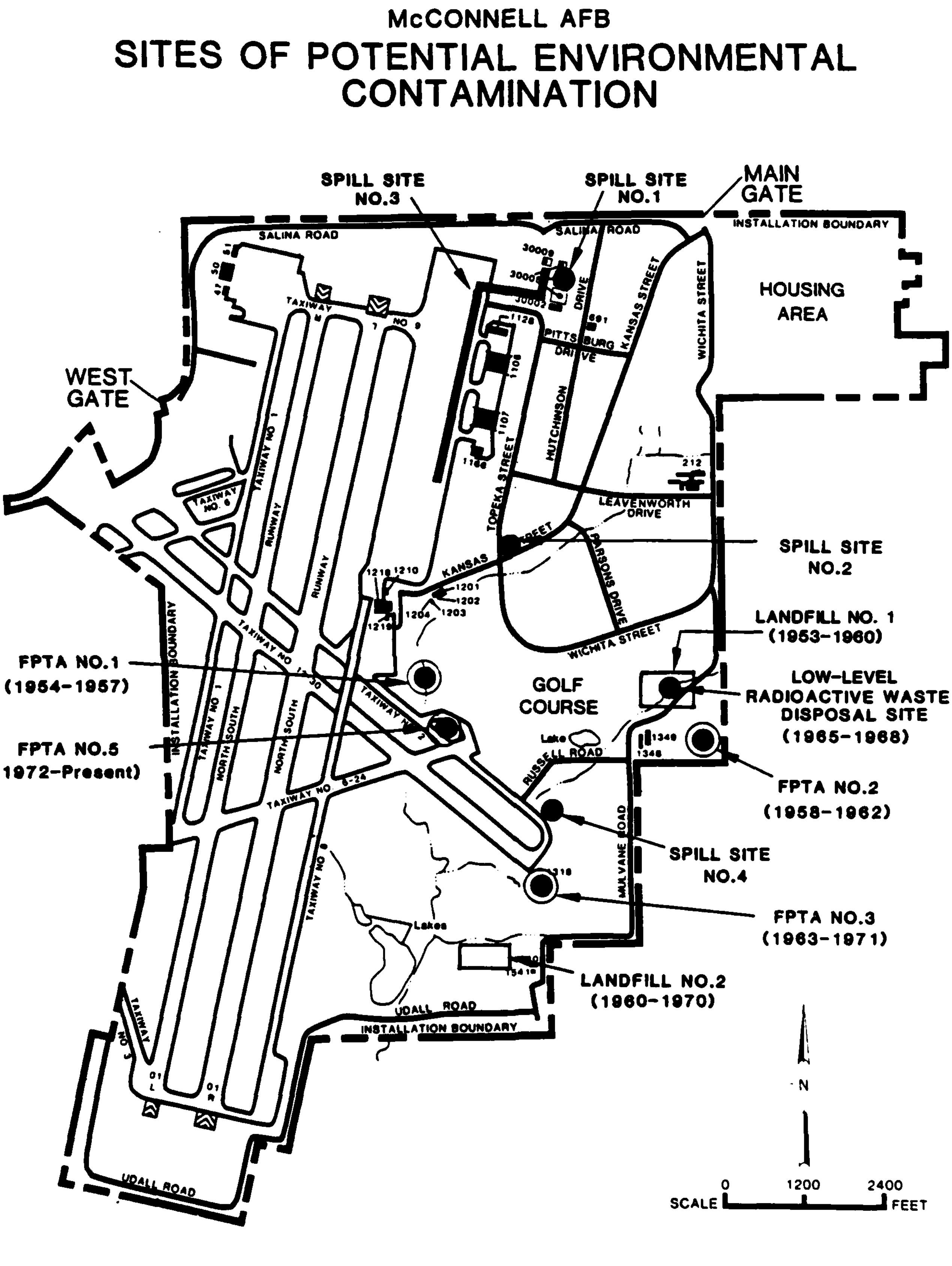
While soil boring and well installation is being performed, readings, with an organic vapor analyzer (OVA) or similar equipment should be made. Such equipment can be used as a screening device to determine those soil samples to be put aside for chemical analyses and can also be used as a health and safety device for the protection of the field crew from potentially harmful organic vapors.

Those sites with a potential for ground-water contamination will be monitored with 4-inch diameter wells consisting of Schedule 40 PVC screens and casing with threaded joints. Screens will be placed 20 feet into the saturated thickness of the uppermost of watertable aquifer. If the initial ground-water samples indicate contamination, additional wells may be required. The number of wells may be reduced if the geophysical techniques are successful in identifying subsurface leachate plumes.

Landfill No. 1

Landfill No. 1 has a potential for environmental contamination and monitoring of this site is recommended. Prior to the well installation, a geophysical survey of the area should be conducted. The survey should be directed at the shallow depths (0-35 feet).

The survey should be used to guide the placement of monitoring wells. Due to the stream that runs through the site, two upgradient and two downgradient wells should be installed within the uppermost aquifer of the site (Figure 6.1) instead of the normal single upgradient well. The wells should be screened approximately 20 feet into the water table



SOURCE: INSTALLATION DOCUMENTS

aquifer, and should terminate at an approximate depth of 35 feet. The wells will be constructed as previously described. It is recommended that water samples from the wells be analyzed for the parameters listed in Table 6.2, List A and for metals (Cd, Cr, Fe, Mn, Ni, As, Hg, Zn).

Smoky Hill Weapons Range Headquarters Disposal Site

The Smoky Hill Weapons Range Headquarters Disposal Site represents a potential for contamination of the environment, and monitoring is recommended. Three soil borings should be made at the drum drainage area where visual inspection indicates soil contamination. An OVA should be operated during the boring procedure. The borings should be terminated at the water table or at 20 feet whichever is encountered first. Soil samples will be taken at 2 ft intervals and where high OVA readings occur and will be analyzed for the parameters listed in Table 6.2 list B.

Two soil borings should be made at the MOGAS tank rupture site on either end of the tank axis. An OVA should be operated during the boring procedure. The borings should be terminated at the water table or at 20 feet which ever is encountered first. Soil samples will be taken at 5 ft intervals and where high OVA readings are encountered. The soil samples will be analyzed for the parameters listed in Table 6.2, List B.

A geophysical survey of the landfill area should be made prior to well installation. The survey should be directed at the shallow depths (0-35 feet). The survey should be used to guide the placement of monitoring wells. At least one upgradient and three downgradient wells should be installed within the uppermost aquifer of the site due to the size of the site and site specific hydrology. The wells should be screened approximately 20 feet into the water table aquifer. The wells will be constructed as previously described. Water samples from the wells will be analyzed for the parameters listed in Table 6.2, List A and Volatile organics (EPA method 601/602).

Fire Protection Training Area No. 2

Fire Protection Training Area No. 2 has a potential for environmental contamination and monitoring of this site is recommended (Figure 6.1). Within the burn area two soil borings should be located where a visual inspection indicates soil contamination. An OVA should be

operated during the boring procedure. The soil borings should be terminated at the water table or at a depth of 20 feet whichever is encountered first. Soil samples should be taken at 5 ft intervals and where high OVA readings occur and should be analyzed for the parameters listed in Table, 6.2 List B.

Fire Protection Training Area No. 3

Fire Protection Training Area No. 3 (Figure 6.1) has a potential for environmental contamination and monitoring of this site is recommended. Within the burn area two soil borings should be located where a visual inspection indicates soil contamination. An OVA should be operated during the boring procedure. The soil borings should be terminated at the water table or at a depth of 20 feet whichever is encountered first. Soil samples taken at 5 ft intervals and where high OVA readings occur should be analyzed for the parameters listed in Table 6.2, list B.

Landfill No. 2

Landfill No. 2 (Figure 6.1) has a potential for environmental contamination and monitoring of this site is recommended. Prior to the well installation, a geophysical survey of the area should be conducted. The survey should be directed at the shallow depths (0-35 feet).

The survey should be used to guide the placement of monitoring wells. Two upgradient and two downgradient wells should be installed within the uppermost aquifer of the site (Figure 6.1) to insure site specific geohydrology is adequately addressed. The wells should be screened approximately 20 feet into the water table aquifer. The wells will be constructed as previously described. Water samples from the wells will be analyzed for the parameters listed in Table 6.2, list A and for metals (Cd, Cr, Fe, Mn, Ni, As, Hg, Zn).

Spill Site No. 3

Spill Site No. 3 (Figure 6.1) has a potential for environmental contamination and sampling and/or monitoring of the site is recommended. Prior to well installation, soil borings and/or geophysical surveys of the area should be conducted. The survey should be directed toward shallow depths (10-15 feet). The surveys should be based on a review of site construction drawings for the pipeline. An OVA should be used during soil borings and well placements. Soil borings should be

terminated at the water table or at a depth indicated by the construction drawings. Soil and/or water samples should be analyzed for the appropriate parameters listed in Table 6.2, List B.

Fire Protection Training Areas No. 1 and No. 5

Fire Protection Training Areas No. 1 and No. 5 (Figure 6.1) have a potential for environmental contamination and monitoring of this site is recommended. Within the burn area two soil borings should be located where a visual inspection indicates gross soil contamination. An OVA should be operated during the boring procedure. The soil borings should be terminated at the water table or at a depth of 20 feet whichever is encountered first. Soil samples taken at 5 ft intervals and where high OVA readings occur should be analyzed for the parameters listed in Table 6.2, list B.

Spill Site No. 1

Spill Site No. 1 (Figure 6.1) is the site of approximately 11,000 gallons of JP-4 loss. This site has the potential for contamination of the environment and monitoring of this site is recommended. Two soil borings should be performed at the site terminating at the water table or at a depth of 20 feet whichever is encountered first. An OVA should be operated during the boring process. Soil samples taken at 5 ft intervals and where high OVA readings are encountered should be analyzed for the parameters listed in Table 6.2 list B.

Low-Level Radioactive Waste Disposal Area

The Low-Level Radioactive Waste Disposal Area (Figure 6.1) has the potential for contamination of the environment, and monitoring is recommended. The site is contained within the confines of Landfill No.1. Water samples should be taken from the 4 wells installed at Landfill No. 1 site and analyzed for Gross Alpha, Gross Beta and Total Radium Content.

Spill Site No. 2

Spill Site No. 2 (Figure 6.1) is the site of a 2,000 gallon MOGAS loss. This site has the potential for environmental contamination and monitoring is recommended. Two soil borings should be made at the site terminating at the water table or at a depth of 20 feet whichever is encountered first. An OVA should be operated during the boring. Soil

samples taken at 2 ft intervals and at high OVA readings should be analyzed for oil and grease and lead.

Three monitoring wells should be installed at the site, one upgradient and two downgradient of the site. The monitoring wells should terminate in the uppermost aquifer of the site, (Figure 6.1) and should be screened 20 feet into the water table aquifer. The wells will be constructed as previously described. Water samples taken from the wells should be analyzed for the parameters listed in Table 6.2 list B.

Missile Site 3-2

Missile Site 3-2 experienced a loss of 2,000 gallons of diesel fuel in March 1983. This site has the potential for environmental contamination and monitoring of this site is recommended. A soil boring should be made at the site, terminating at the depth indicated by a review of the site construction drawings reflecting the lowest elevation of the transfer pipe. An OVA should be operated during the boring. A soil sample should be taken where the boring terminates and analyzed for oil and grease. Three monitoring wells should be installed at the site, one well should be hydraullically upgradient, and two should be hydraulically downgradient of the site. The wells should be screened approximately 20 feet into the water table aquifer. The wells will be constructed as previously described. Water samples taken from the wells should be analyzed for oil and grease and volatile organics.

Spill Site No. 4

Spill Site No. 4 (Figure 6.1) has a potential for environmental contamination because of the persistance and volume of materials involved and a survey of the site is recommended. Shallow soil borings should be taken at 3 locations and sampled for HYVAR X-L, Bromocil and other pesticides and herbicides indicated by a review of pesticide and herbicides usage during 1983 and 1984. Contamination if present, is not suspected to have penetrated beyond three feet in depth, but sampling should continue with greater depth and number of borings to define extent of contamination if preliminary samples indicate persistant and unacceptable levels of pesticides and herbicides are present.

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APPENDIX A

BIOGRAPHICAL DATA

Biographical Data

ERNEST J. SCHROEDER

Environmental Engineer
PII Redacted Manager, Solid and Hazardous Waste Dept.

[redacted]

Education

B.S. in Civil Engineering, 1966, University of Arkansas, Fayetteville, Arkansas
M.S. in Sanitary Engineering, 1967, University of Arkansas, Fayetteville, Arkansas

Professional Affiliations

Registered Professional Engineer (Arkansas No. 3259, Georgia No. 10618, and Texas No. 33556)
Water Pollution Control Federation
American Academy of Environmental Engineers

Honorary Affiliations

Chi Epsilon

Experience Record

1967-1976 Union Carbide Technical Center, Engineering Department, South Charleston, West Virginia (1967-1968). Project Engineer. Responsible for environmental protection engineering projects for various organic chemicals and plastics plants.

Union Carbide Corporation, Environmental Protection Department, Texas City, Texas (1969-1975). Project Engineer and Engineering Supervisor. Responsible for various aspects of plant pollution abatement programs, including preparation of state and federal permits for wastewater treatment activities, operations representative on $8 million regional wastewater treatment project (process design, detailed design, construction and startup), and supervisor for operation of wastewater collection and treatment facilities.

Union Carbide Corporation, Environmental Protection Project Engineer, Toronto, Ontario, Canada (1975-1976). Responsible for the environmental permitting and engineering design of waste treatment systems associated with a new refinery.

Ernest J. Schroeder (Continued)

1976-Date Engineering-Science, Inc., Project Manager (1976-1978). Engineering and project management of various industrial wastewater and hazardous waste projects.

Engineering-Science, Inc., Manager of the Industrial Waste Group in the Atlanta, Georgia office (1978-1980). Responsible for the supervision of industrial waste project managers and project engineers and the management of industrial waste studies conducted in the office. Also directly involved in project management consulting with clients on environmental studies and environment assessment projects, e.g., project manager for several spill control and wastewater treatability projects and for a third-party EIS for a new phosphate mine in Florida.

Engineering-Science, Inc., Manager of Solid and Hazardous Waste Group in the Atlanta, Georgia office (1980-date). Responsible for the supervision of solid and hazardous waste project managers and project engineers and the management of solid and hazardous waste projects in the office. Project activities have included permit and regulatory assistance, environmental audits, waste management program development, delisting partitions, ground-water monitoring, landfill evaluations, landfill closure design, hazardous waste management, waste inventory, waste recovery/recycle evaluation, waste disposal alternative evaluation, transportation evaluation, and spill control and countermeasure planning, HRS evaluations, preparation of remedial investigations and feasibility studies, and design and construction supervision for hazardous waste site cleanup.

Project Manager for fourteen Phase I Installation Restoration Program projects for the U.S. Air Force. The objective of this program is to audit past hazardous waste disposal practices that could result in migration of contaminants and recommend priority sites requiring further investigation. Also conducted environmental audits (air, water and solid waste) at ten industrial facilities. Project manager for a contamination assessment and hazardous waste site cleanup conducted for an industrial client as part of a consent decree agreement. Project manager for site investigation and contamination assessment projects at multiple hazardous waste sites in the northeast. Project manager for preparation of two Remedial Investigation/Feasibility Studies.

Biographical Data

JOHN R. ABSALON
Hydrogeologist

PII Redacted

[redacted]

Education

B.S. in Geology, 1973, Upsala College, East Orange, New Jersey

Professional Affiliations

Certified Professional Geologist (Indiana No. 46) (Virginia No. 241)
Association of Engineering Geologists
Geological Society of America
National Water Well Association

Experience Record

1973-1974 Soil Testing Incorporated-Drilling Contractors, Seymour, Connecticut. Geologist. Responsible for the planning and supervision of subsurface investigations supporting geotechnical, ground-water contamination, and mineral exploitation studies in the New England area. Also managed the office staff, drillers, and the maintenance shop.

1974-1975 William F. Loftus and Associates, Englewood Cliffs, New Jersey. Engineering Geologist. Responsible for planning and management of geotechnical investigations in the northeastern U.S. and Illinois. Other duties included formal report preparation.

1975-1978 U.S. Army Environmental Hygiene Agency, Fort McPherson, Georgia. Geologist. Responsible for performance of solid waste disposal facility siting studies, non-complying waste disposal site assessments, and ground-water monitoring programs at military installations in the southeastern U.S., Texas, and Oklahoma. Also responsible for operation and management of the soil mechanics laboratory.

1978-1980 Law Engineering Testing Company, Atlanta, Georgia. Engineering Geologist/Hydrogeologist. Responsible for the project supervision of waste management, water quality assessment, geotechnical, and hydrogeologic studies at commercial, industrial, and government facilities. General experience included planning and management of several ground-water monitoring programs,

John R. Absalon (Continued)

development of remedial action programs, and formulation of waste disposal facility liner system design recommendations. Performed detailed ground-water quality investigations at an Air Force installation in Georgia, a paper mill in southwestern Georgia, and industrial facilities in Tennessee.

1980-Date Engineering-Science. Hydrogeologist. Responsible for supervising efforts in waste management, solid waste disposal, ground-water contamination assessment, leachate generation, and geotechnical and hydrogeologic investigations for clients in the industrial and governmental sectors. Performed geologic investigations at twelve Air Force bases and otherindustrial sites to evaluate the potential for migration of hazardous materials from past waste disposal practices. Conducted RCRA ground-water monitoring studies for industrial clients and evaluated remedial action alternatives for a county landfill in Florida. Conducted quality management, hydrogeologic and ground-water quality programs for the pulp and paper industry at several mills located in the Southeast United States.

Publications and Presentations

Eleven presentations and/or papers in technical publications or conferences dealing with geology, ground water, and waste disposal/-ground water interaction.

Biographical Data

ROBERT D. STEPHENS
Environmental Scientist

PII Redacted

[redacted]

Education

B.A. Biology - 1971, Berea College, Berea Kentucky
Graduate Studies, Environmental Engineering 1973-1974, University of Cincinnati, Cincinnati, Ohio

Professional Affiliations, Honors and Awards

Air Pollution Control Association
Water Pollution Control Federation

Experience Record

1971-1973 Kentucky Department of Health Air Pollution Control Group, Regional Manager of a nine county region in northern Kentucky. Responsible for enforcement of State Air Reglations, Air Monitoring and Public Liason.

1973-1974 Envirico, Covington, Kentucky. Operated as a consultant in Air Pollution Control, OSHA Programs, Water Pollution Control and Solid Waste Disposal. Projects included asbestos waste disposal, and waste disposal from a drum recycling plant.

1974-1977 Pedco Environmental Specialists, Cincinnati, Ohio served as chief technical investigator on various contracts dealing with air pollution control and management.

1977-1978 Florida Department of Environmental Regulation, Environmental Specialist, provided technical support to Enforcement Group on various air pollution problems.

1978-1984 Mobil Chemical Company.

1978-1981, Manager Environmental Permitting, South Fort Meade Project Nichols, Florida. Structured, staffed and directed an environmental permitting effort and obtained required federal permits for an 18,000 acre grassroots phosphate mine. Waste disposal planning activities were a major part of the project.

Robert D. Stephens (Continued)

1981-1983, Manager Environmental Control, Phosphorus Division Richmond, Virginia. Responsible for the Environmental Integrity of 27 operating units at 11 plant locations throughtout the U.S. Designed, conducted and managed environmental studies to modify NPDES permit requirements for phosphoric acid production facility. Designed, implemented, and managed a program to conduct environmental audits of division plants. Planned and executed an investigation of subsurface site conditions at a major phosphorus chemical production facility. Initial findings of pesticide contamination in the area resulted in a study expansion to assess affects of specific pesticide residues in the biological community and the ultimate impact on humans.

1983-1984, Manager Environmental Control Chemical Products Richmond, Virginia. Responsible for Environmental Integrity of 50 operating units at 27 plant locations throughout the U.S. Directed preparation of a "Part B" Hazardous Waste Permit Application for a major phosphorus-based chemical operation in South Carolina. Instituted novel approach resulting in approval of application without modification by regulatory authorities. Planned and executed the environmental program which resulted in official sanction of phospho-gypsum, a hazardous waste in Texas, as an environmentally acceptable aggregate within the State of Texas. Approvals received from Texas Board of Health, Bureau of Radiation control, Texas Department of Water Resources, and Texas Air Control Board. Planned and executed a program to obtain a variance to state and federal water pollution control laws to allow continued operation of a fertilizer intermediates plant and the leaking waste gypsum pond associated with the plant. Provided expert testimony in this environmental litigation.

1985-Date Engineering-Science. Project Engineer, responsible for hazardous waste site assessment studies conducted for industry and Department of Defense.

Publications

"Water Quality in Rural Madison County," Kentucky Department of Health, Division of Sanitary Engineering, 1971

"Evaluation of the Mobil Ground Water Assessment Protocol at the Mobil Chemical Company, Charleston, S.C. Plant Site," Mobil Chemical Company, Phosphorus Division, 1983

"Biological Studies on Paddys Run Creek, Fernald, Ohio," Mobil Chemical Company, Chemical Products Division, 1984

Biographical Data

ROBERT W. O'BRIEN

PII Redacted

Chemical Engineer

[redacted]

Education

B.S., Chemical Engineering, 1980, Illinois Institute of Technology

M.S., Chemical Engineering, 1982, Purdue University

Professional Affiliations

American Institute of Chemical Engineers

Honorary Affiliations

Tau Beta Pi

Experience Record

Summer Employment 1977-1979	American Maize Products Co., Hammond, IN. Production Engineer: Supported production efforts through projects designed to improve process operations. Institute of Gas Technology Chicago, IL. Research Assistant, Coal Gasification: Investigated the relationship between various operating characteristics and the agglomeration of ash particles during fluidization. Oscar Mayer & Co., Chicago, IL. Project Engineer, Plant Maintenance: Evaluated the mechanical parts inventory and made changes as necessary for cost savings.
Summer 1980	Amoco Oil Co., Amoco Research Center, Naperville, IL. Research Engineer, Catalysis Division: Operated a pilot plant preparing alumina catalyst supports. Identified and correlated some of the important operating variables with the alumina's structural properties. Responsible for planning, performing, and analyzing laboratory results of each run.
1980-1982	Purdue University, School of Chemical Engineering, W. Lafayette, IN. Research Assistant, Computer Aided Design: Developed a process simulator to aid in modeling multiproduct multipurpose batch plants. Incorporating an integrated sequential process control scheme, the simulator allows an analyst to test proposed schedules in batch plants, determine the effects of intermediate storage on operations, and

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Robert W. O'Brien (Continued)

find a plant's equipment utilization. Also wrote equipment modules for Purdue's steady-state process flowsheeting system.

1983 American Design Company, Hartford, CT. Systems Engineer: Contract engineer assigned to United Technologies, Power Systems Division. Worked in support of the 40 KW fuel cell program. Investigated possible causes of plugging phenomenon in coolant lines. Analyzed field data to predict failures.

1984 Engineering-Science, Fairfax, VA. Project Engineer: Evaluation of kinetic data from a feasibility study to determine chemical desensitization methods for explosive-laden lagoon sediments. Evaluation included computerized modeling methods.

Publications

M.S. Thesis, Purdue University, 1982, "Simulation Modeling of Batch/Semicontinuous Processes."

Biographical Data

JAMES R. BUTNER

Environmental Scientist

PII Redacted

[redacted]

Education

B.S. Tulane University, Biological Sciences, 1976
M.S. University of Florida, Environmental Engineering Sciences, 1983

Professional Affiliations

Water Pollution Control Federation
Society of Wetlands Scientists
PADI

Experience Record

1976	Marine Resources Specialist, Massachusetts Department of Natural Resources. Mr. Butner was involved in an Analysis of the Boston Harbor Islands and Near Shore Resources for the new Harbor Islands State Park and Marine Sanctuary developing surveys to assist DNR in identifying valuable resource areas for park development and operation decisions.
1977-1979	Horticultural industry in Gainesville, Florida. Primary areas of experience were in botany, evaluation of the uses of native plant species, resource evaluation, and business management.
1979-1981	Center for Wetlands, University of Florida. His involvement focused on evaluating the public health aspects of wastewater recycling through wetlands, the subject of his Master's thesis. Mr. Butner's other activities included modeling the survivorship of pathogens in surface and ground waters, vegetation analysis, application of computer statistical software (SAS) to large data sets, and digital and analog modeling. Mr. Butner's coursework included graduate level courses in Environmental Engineering, Environmental Chemistry, Coastal and Marine Systems, Nutrients and Eutrophication, Water Resources Planning, Fortran Programming, Toxicology, and Ecological Modeling and Statistics.

1981-1982 While in graduate school, Mr. Butner worked as a chlorophyll consultant for an estuarine resources impact evaluation study conducted by Jones Edmonds and Associates for the U.S. Navy at Kings Bay, Georgia.

1982-1984 Claude Terry & Associates, Inc. (CTA). As an Environmental Scientist, his primary responsibilities were involved the collection, review and analysis of technical data and institutional issues associated with effluent discharge into wetlands. These duties were in conjunction with the production of a generic eight-state Environmental Impact Statement for Region IV EPA entitled "Freshwater Wetlands for Wastewater Management." Other projects have involved conducting environmental inventories and recommending mitigation to preserve and protect human and natural resources for other EIS work. He was involved in the design of various sampling programs, and the collection, analysis, and interpretation of chlorophyll and periphyton data as part of the Georgia Statewide Nonpoint Source Study.

1984-Date Engineering-Science, Inc. Environmental Scientist responsible for the development of environmental studies, hazardous waste audits and inventories, and development of permitting materials for industrial and governmental projects. Mr. Butner is currently working on several Hazardous Waste Management Projects at GM-Lakewood Plant that encompass solid and hazardous waste identification, classification and disposal recommendations.

Publications

Butner, J. 1984. Contributor to Cypress Swamps by H. T. Odum and K. C. Ewel (eds.). University of Florida Press, Gainesville, Florida.

Butner, J. and G. Bourne, 1984. Freshwater Wetlands for Wastewater Management: An Integrated Framework for Decision-Making and Wetlands Protection. 22nd Annual Duke Conference on Environmental Technology, Research Triangle, Raleigh, North Carolina.

Bitton, G., P. Chow, and J. Butner, 1983. Modeling the Survival of Pathogenic and Indicator Organisms in Ground Water. Groundwater, 21, 405-409.

APPENDIX B

LIST OF INTERVIEWEES AND OUTSIDE AGENCY CONTACTS

TABLE B.1
LIST OF INTERVIEWEES

	Position	Years at McConnell AFB
1.	NCIOC, Corrosion Control	4
2.	NCOIC, Electronics Lab	8
3.	NCOIC, Facility Support	10
4.	NCO, Pneudraulic Shop	1
5.	NCO, Propellant Cleaning Room	8
6.	NCOIC, Propellant Transfer Service	5
7.	NCOIC, Bulk Fuels Storage/LOX	1
8.	NCOIC, Fuels Laboratory	2
9.	NCOIC, Diagnostic Q&A	1
10.	Civilian, Fire Truck Maintenance	1
11.	Civilian, General Purpose Maintenance	10
12.	NCOIC, Refueling Maintenance	1
13.	Civilian, Special Purpose Maintenance	30
14.	NCOIC, Precision Measurement Lab	3
15.	Civilian, AGE Shop	11
16.	NCOIC, Corrosion Control	2
17.	NCO, Corrosion Control	2
18.	NCO, Electric/Battery Shop	4
19.	NCOIC, Engine Conditioning	4
20.	NCOIC, Fuels Systems Repair Shop	5
21.	NCO, Jet Engine Intermediate Maintenance	4
22.	NCOIC, Non-Destructive Testing	10
23.	NCOIC, Repair and Reclamation Shop	4

TABLE B.1
LIST OF INTERVIEWEES
(CONTINUED)

	Position	Years at McConnell AFB
24.	NCOIC, Small Gas Turbine Maintenance	1
25.	NCOIC, Jet Engine Test Cell	5
26.	NCOIC, Non-Powered AGE	3
27.	NCO, Tanker Inspection	3
28.	NCOIC, Transient Alert	6
29.	Civilian, Auto Hobby Shop	5
30.	NCOIC, Graphics Shop, Photo Laboratory	1
31.	NCO, Small Arms Range	5
32.	Civilian, Entomology	11
33.	Civilian, Exterior Electric	3
34.	Civilian, Golf Course Maintenance	4
35.	Civilian, Heating Shop	32
36.	Civilian, Liquid Fuels Maintenance	30
37.	Civilian, Paint Shop	11
38.	NCOIC, Dental Lab	4
39.	NCOIC, Dental X-Ray	6
40.	NCO, Medical Maintenance	3
41.	Civilian, Radiology	6
42.	Civilian, Mechanical Shop	3
43.	NCOIC, Motor Pool	23
44.	NCOIC, Photo Laboratory	12
45.	Civilian, Aerospace Ground Equipment Shop	15
46.	NCO, Corrosion Control	2

TABLE B.1
LIST OF INTERVIEWEES
(CONTINUED)

	Position	Years at McConnell AFB
47.	NCOIC, Jet Engine Shop	18
48.	NCOIC, Fuel System Repair	5
49.	NCOIC, Gun Services	10
50.	NCOIC, Phase Inspection	13
51.	NCOIC, Weapons Release	22
52.	NCOIC, Wheel & Tire Shop	4
53.	NCOIC, Hydraulics Shop	18
54.	NCO, Medical & Dental X-Ray	5
55.	Civilian, DPDO	4
56.	NCOIC, T-37 Maintenance Section	5
57.	NCOIC, Helicopter Maintenance	3
58.	Public Affairs Officer	4
59.	Commander, Missile Combat Crew	4
60.	NCO, Missile Combat Crew	2
61.	NCO, Missile Combat Crew	5
62.	Chief Environmental Health Branch USAF/OEHL	7
63.	Deputy Commander, Operations, KANG	22
64.	Commander, Missile Combat Crew	1
65.	Civilian, USAF Representative Boeing Aircraft Co.	12
66.	Civilian, Property Disposal Officer	15
67.	Deputy Commander, Maintenance Superintendent	7
68.	Civilian, Chief Missile Engineering	21
69.	Chief, Base Bioenvironmental Engineering	3

TABLE B.1
LIST OF INTERVIEWEES

Position	Years at McConnell AFB
70. Base Bioenvironmental Engineer	8
71. Civilian, Chief Missile Engineering, Offutt AFB	10
72. NCOIC, Heavy Equipment Shop, ANG, Smoky Hill	14
73. NCOIC, Motor Pool, ANG, Smoky Hill	3
74. Civilian, National Industrial Environmental Services	N/A
75. Civilian Real Property Office	5
76. Civilian Supervisor, Roads and Grounds	9
77. Civilian Foreman, Pavements	10
78. Civilian Retired Heavy Equipment Operator	20
79. Civilian, Assistant Fire Chief	10
80. Civilian, Lead Fire Fighter	14
81. Civilian, Retired Fire Chief	25
82. Civilian, Liquid Fuels Maintenance Foreman	23
83. Civlian, Civil Engineering	24
84. Civilian, Chief Engineering and Environmental Planning	15
85. NCOIC, RV Branch 381st MIMS	2
86. Civilian, Retired 381st SMW Safety Officer	5
87. Civilian, Golf Course Superintendent	5
88. Civilian, Boiler Operator Foreman	19
89. Civilian, Retired, Heavy Equipment Operator	16
90. Civilian, Manager of Service Shoppette	1
91. Civilian, Dep. Chief of CE Operations	14
92. Civilian, Dep. Civil Engineer	19

TABLE B.2
OUTSIDE AGENCY CONTACTS

J. B. Gillespie, Research Hydrologist
U. S. Geological Survey Water Resources Division
1950 Constant Avenue, Campus West
University of Kansas
Lawrence, Kansas 66045
913/864-4321

Dale Stuckey, Environmental Technician
Kansas Department of Health and Environment
202 Century Plaza
111 West Douglas
Wichita, Kansas 67202
316/265-3181

Marla Noak, Environmental Engineer
Hazardous Waste Division
Kansas Department of Health and Environment
Forbes Field
Topeka, Kansas 66620
913/862-9360

Douglas R.Hahn, Director
Sedgwick County Environmental Resources Department
510 North Main
Wichita, Kansas 67203
316/268-7380

George Huenergardt, Chief Air Quality Control
Wichita-Sedgwick County Department of Community Health
1900 East Ninth
Wichita, Kansas 67214
316/268-8449

Mr. W. Lewis
Modern Military Field Branch
Washington National Record Center
4025 Suitland Road
Suitland, MD
301/763-1710

Mr. J. Dwyer
Cartographic and Architectural Branch
National Archives
841 S. Pickett Street
Alexandria, VA 22304
703/756-6700

Mr. E. Reese
Modern Military Branch
National Archives
8th and Pennsylvania Avenue
Wasington, DC
202/523-3340

APPENDIX C

TENANT MISSIONS

APPENDIX C

TENANT MISSIONS

381ST STRATEGIC MISSILE WING, SAC

The primary mission of the 381st SMW is to develop and maintain the required state of readiness for 18 Titan II Intercontinental Ballistic Missiles.

USAF HOSPITAL MCCONNELL

The mission of the USAF Hospital is to provide the medical support necessary to maintain the highest degree of combat readiness and effectiveness of the 381st SMW, 384th AREFW, and support elements assigned to McConnell Air Force Base, Kansas.

184TH TACTICAL FIGHTER GROUP, (KANG.)

The mission of the 184th Tactical Fighter Group is to train personnel and maintain equipment associated with the F4-D phantom aircraft, and perform various operational missions assigned by SAC.

The 184th also maintains and operates the Smoky Hill Weapons Range for personnel training and combat simulation and provide emergency assistance to the state.

The mobilized 184th support the SIOP through launch, execution, and recovery of aircraft; or maintain aircraft on alert; or perform contingency operations; or a combination of alert, and contingency operations, as directed by CINSAC.

DETACHMENT 23, 26TH WEATHER SQUADRON, (MAC)

The mission of Detachment 23, 26th Weather Squadron is to provide EWO and peacetime meteorological support as required by the 381st SMW, the 384th AREFW, the 184th TFG, KANG, and other base and off base military units. Provide forecasting and observing services in support of the Air Weather Service Global Weather Concept and the unique missions

of the various organizations assigned to McConnell Air Force Base, and to complete special projects as directed by higher weather headquarters.

DETACHMENT 6, 37TH AEROSPACE RESCUE AND RECOVERY SERVICE, (MAC)

The primary mission of Detachment 6, 37th Aerospace Rescue and Recovery Service (ARRS) is to support the 381st SMW activities. This support varies from routine daily missile crew changes to providing security surveillance for movement of Class A resources, emergency parts delivery, distinguished visitor transportation, and emergency disaster response operations.

DETACHMENT 3, 47TH FLYING TRAINING WING (ATC)

The primary mission of Detachment 3, 47th Flying Training Wing is to give KC-135 Co-pilots greater opportunites to develop air judgements, decision making expertise under stress, and self confidence by providing in-flight command of an aircraft.

2155TH INFORMATION SYSTEMS SQUADRON

The primary mission of the 2155th Information Systems Squadron is to fully support the 381st SMW, 384th AREFW, the Kansas Air National Guard, the Detachment 3, 47th FTW, and Detachment 6, 37th ARRS. Also covered are communication electronics, meteorological air traffic control support, navigational aid, communications and maintenance. In addition, the unit is responsible for all communication systems for the Titan II missile complexes assigned to McConnell AFB.

FIELD TRAINING, DETACHMENT 401, 3785TH FIELD TRAINING GROUP (ATC)

The mission of the Field Training Detachment 401 is to provide training in all phases of KC-135 maintenance to technicians from the 384th ARF and other military personnel as assigned. In addition, the Field Training Detachment is responsible for providing On-Job-Training and Advisory Assistance to McConnell AFB and Air National Guard organizations in the area.

DETACHMENT 34, 3904TH MANAGEMENT ENGINEERING SQUARDON, SAC

The mission of Detachment 34, 3904th Management Engineering Squadron is to provide the capability for improved management of USAF/SAC resources through the development of manpower standards and management engineering improvement studies, and by rendering assistance to SAC Commanders in the area of manpower, organization and management advisory consulting service.

DEFENSE PROPERTY DISPOSAL OFFICE (DPDO)

Maintains and operates facilities to provide disposal service for the Department of Defense.

APPENDIX D

SUPPLEMENTAL BASE FINDINGS INFORMATION

TABLE D.1
TANK INVENTORY MCCONNELL AFB

Tank No Fac. No.	Age	Capacity (Gallons)	Construction of	Material Stored	Grade A = Aboveground B = Belowground
47	1953	500	Steel	No. 2 Heating Fuel	A
46	1964	500	Steel	JP-4	A
46	1964	500	Steel	Unleaded Gas	A
43	1962	2,500	Steel	Diesel	A
43	1974	6,000	Steel	MoGas	A
48	1976	3,000	Fiberglass	No. 2 Heating Fuel	B
41	1984	12,000	Fiberglass	No. 2 Heating Fuel	B
37	1980	2,000	Fiberglass	No. 2 Heating Fuel	B
49	1980	8,000	Fiberglass	No. 2 Heating Fuel	B
1120	1984	1,000	Steel	No. 2 Heating Fuel	B
978	1952	3,000	Steel	No. 2 Heating Fuel	B
1106N	1952	20,000	Steel	No. 2 Heating Fuel	B
11065	1952	20,000	Steel	No. 2 Heating Fuel	B
1169	1952	11,750	Steel	No. 2 Heating Fuel	B
327	1952	12,000	Steel	No. 2 Heating Fuel	B
410	1984	10,000	Steel	No. 2 Heating Fuel	B
421	1952	10,000	Steel	No. 2 Heating Fuel	B
197	1984	10,000	Steel	No. 2 Heating Fuel	B
732	1952	10,000	Steel	No. 2 Heating Fuel	B
430	1952	4,000	Steel	De-Icing Fluid*	B
430	1952	4,000	Steel	De-Icing Fluid*	B
430	1952	4,000	Steel	De-Icing Fluid*	B

TABLE D.1
TANK INVENTORY MCCONNELL AFB

Tank No Fac. No.	Age	Capacity	Construction of	Material Stored	Grade A = Aboveground B = Belowground
430	1952	4,000	Steel	De-Icing Fluid*	B
1171	1953	2,000	Steel	JP-4	B
1171	1953	2,000	Steel	MoGas	B
1171	1953	2,000	Steel	MoGas	B
708	1953	7,500	Steel	MoGas	B
708	1953	7,500	Steel	MoGas	B
1101	1951	25,000	Epoxy Coated Steel	JP-4	B
1101	1951	25,000	Epoxy Coated Steel	JP-4	B
1101	1951	25,000	Epoxy Coated Steel	JP-4	B
1100	1951	25,000	Epoxy Coated Steel	JP-4	B
1100	1951	25,000	Epoxy Coated Steel	JP-4	B
1100	1951	25,000	Epoxy Coated Steel	JP-4	B
964	1951	5,000	Steel	Unleaded Gasoline	B
964	1951	5,000	Steel	Diesel Fuel	B
964	1951	10,000	Steel	Diesel Fuel	B
964	1951	5,000	Steel	De-icing Fluid	B
408	1984	10,000	Steel	No. 2 Heating Fuel	B
1110	1952	4,000	Steel	No. 2 Heating Fuel	B
312	1952	3,000	Steel	No. 2 Heating Fuel	B
522	1952	3,000	Steel	No. 2 Heating Fuel	B
695	1952	3,000	Steel	No. 2 Heating Fuel	B

TABLE D.1
TANK INVENTORY MCCONNELL AFB

Tank No Fac. No.	Age	Capacity	Construction of	Material Stored	Grade (A = Aboveground, B = Belowground)
319	1952	3,000	Steel	No. 2 Heating Fuel	B
320	1952	3,000	Steel	No. 2 Heating Fuel	B
1170	1952	2,500	Steel	No. 2 Heating Fuel	B
1201	1952	6,000	Steel	No. 2 Heating Fuel	B
1170A	1952	2,500	Steel	No. 2 Heating Fuel	B
402	1952	2,000	Steel	No. 2 Heating Fuel	B
404	1952	2,000	Steel	No. 2 Heating Fuel	B
739	1952	2,000	Steel	No. 2 Heating Fuel	B
801	1952	4,000	Steel	No. 2 Heating Fuel	B
804	1952	2,000	Steel	No. 2 Heating Fuel	B
510	1952	2,000	Steel	No. 2 Heating Fuel	B
806	1952	2,000	Steel	No. 2 Heating Fuel	B
692	1952	2,000	Steel	No. 2 Heating Fuel	B
202	1952	1,500	Steel	No. 2 Heating Fuel	B
1090	1952	10,000	Steel	No. 2 Heating Fuel	B
710	1952	7,000	Steel	No. 2 Heating Fuel	B
691	1952	8,000	Steel	No. 2 Heating Fuel	B
317	1952	8,000	Steel	No. 2 Heating Fuel	B
212	1952	7,150	Steel	No. 2 Heating Fuel	B
1108	1952	7,000	Steel	No. 2 Heating Fuel	B
334	1952	5,000	Steel	No. 2 Heating Fuel	B
1111	1952	5,000	Steel	No. 2 Heating Fuel	B
1128	1952	3,000	Steel	No. 2 Heating Fuel	B

TABLE D.1
TANK INVENTORY MCCONNELL AFB

Tank No Fac. No.	Age	Capacity	Construction of	Material Stored	Grade A = Aboveground B = Belowground
1180	1952	3,000	Steel	No. 2 heating Fuel	B
1182	1952	3,000	Steel	No. 2 Heating Fuel	B
1127	1952	3,000	Steel	No. 2 Heating Fuel	B
1166	1978	10,000	Steel	No. 2 Heating Fuel	B
1218	1952	8,000	Steel	No. 2 Heating Fuel	B
2088	1952	300	Steel	No. 2 Heating Fuel	B
1560	1952	1,000	Steel	No. 2 Heating Fuel	B
352	1952	8,000	Steel	No. 2 Heating Fuel	B
338	1952	2,000	Steel	No. 2 Heating Fuel	B
515	1952	1,000	Steel	No. 2 Heating Fuel	B
1411	1952	1,500	Steel	No. 2 Heating Fuel	B
520	1952	1,500	Steel	No. 2 Heating Fuel	B
803	1952	1,000	Steel	No. 2 Heating Fuel	B
948	1952	1,000	Steel	No. 2 Heating Fuel	B
950	1952	1,000	Steel	No. 2 Heating Fuel	B
1404	1952	1,000	Steel	No. 2 Heating Fuel	B
1501	1952	2,000	Steel	No. 2 Heating Fuel	B
1409	1952	1,000	Steel	No. 2 Heating Fuel	B
1105	1952	760	Steel	No. 2 Heating Fuel	B
1349	1983	4,000	Steel	No. 2 Heating Fuel	B
1419	19512	550	Steel	No. 2 Heating Fuel	B
51	1984	16,500	Steel	Liquid Propane	B
50	1984	12,000	Steel	Liquid Propane	B

TABLE D.1
TANK INVENTORY MCCONNELL AFB

Tank No Fac. No.	Age	Capacity	Construction of	Material Stored	Grade A = Aboveground B = Belowground
50	1984	500	Fiberglass	JP-4	B
52	1985	500	Fiberglass	JP-4	B
33	1984	10,000	Fiberglass	Diesel	B
33	1984	10,000	Fiberglass	Regular Gas	B
33	1984	10,000	Fiberglass	Unleaded Gas	B
9	1972	1,000	Steel	AVGAS	B
30002(#3)	1952	70,000	Steel	MoGas	A
30002(#4)	1953	70,000	Steel	Currently Empty	A
30005(#1)	1953	1,000,000	Steel	JP-4	A
30005(#2)	1953	1,000,000	Steel	JP-4	A
30005(#5)	1953	500,000	Steel	JP-4	A
30009(#16)	1953	400,000	Steel	Fuel Oil	A
#12	1953	15,000	Steel	Unleaded Gasoline	B
#13	1953	15,000	Steel	De-icing Fluid	B
#15	1953	15,000	Steel	Diesel	B
1308	1978	2,000	Steel	Waste JP-4	B

*Waste Fuel Prior to 1982

Source: SPCC Plan

TABLE D.2
STORAGE FACILITIES AT
SMOKY HILL WEAPONS RANGE

Facility Number	Capacity In Gallons		Grade (A = Above Ground, B = Below Ground)
4001	1,000	Fuel Oil	B
6001	1,000	Fuel Oil	B
	6,000	Fuel Oil	B
	6,565	Propane	A
HQ POL	330	Oil	A
	55	Waste Oil	A
6003	500	Water	B
	1,000	Propane	A
6011	2,000	Fuel Oil	B
6013	1,000	Fuel Oil	B
	1,000	Water	B
	55	Waste Oil	A
6019	500	Water	B
21610	2,500	Mo-Gas	B
21812	2,000	Diesel Fuel	B
	Two 1,000	Diesel Fuel	B
OPS POL	220	Oil	A

Notes: Facility 6001 has an underground tank of unknown size and contents.

Facility 21812 has three underground tanks of unknown size and contents.
The tanks had Mo-Gas in them at one time.

Facility 6001 has a paint storage room.

TABLE D.3

LIST OF PESTICIDES

Malathion
Sevin
Organophosphate
Pyrethrum
Diazinon
Baygen
Anti-coagulant
All-repell
Chlordane
Larvacide granules
Borate 2,4,P
Ocombherb

Source: McConnell AFB records

APPENDIX E

MASTER LIST OF INDUSTRIAL SHOPS

MCCONNELL AFB

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
McCONNELL AFB

Name	Location (Bldg. No.)	Hazardous Materials	Hazardous Wastes	Typical Storage, Treatment Disposal Methods
381 Missile Maintenance Squadron				
Conventional Munitions Maintenance	1420	Yes	No	-
Corrosion Control	1107	Yes	Yes	DPDO, Neutralization and dilution to sanitary sewer
Electronics Lab	1107	Yes	Yes	Sanitary Sewer
Environmental Systems	1107	Yes	No	-
Facility Electric Shop	1107	Yes	No	-
Facility Support	1107	Yes	Yes	Sanitary Sewer, DPDO, Boiler
Pneudralic Shop	1107	Yes	Yes	DPDO, Boiler
Missile Handling	1107	Yes	No	-
Protective Clothing	1107	Yes	No	-
Propellant Cleaning Room	1107	Yes	Yes	Holding tank, neutralization to sanitary sewer
Propellant Transfer Services	1107	Yes	Yes	Holding tank, neutralization to sanitary sewer

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
McCONNELL AFB

Name	Location (Bldg. No.)	Hazardous Materials	Hazardous Wastes	Typical Storage, Treatment Disposal Methods
381 Missile Maintenance Squadron (Continued)				
Re-entry Vehicle Maintenance	1411	Yes	No	-
Refrigeration Shop	1107	Yes	No	-
384 Supply Squadron				
Bulk Fuels Storage/LOX	982 and 965	Yes	Yes	FPTA
Fuels Delivery	1169	Yes	No	-
Fuels Laboratory (Admin.)	990	Yes	Yes	FPTA, Neutralized to Sanitary Sewer
384 Transportation Squadron				
Allied Trades	710	Yes	No	-
Diagnostic Q & A	710	Yes	Yes	DPDO, Boiler, and Neutralization to Sanitary Sewer
Fire Truck Maintenance	1201	Yes	Yes	DPDO, Boiler
General Purpose Maintenance	710	Yes	Yes	DPDO, Boiler
Packing and Crating	1090	Yes	No	-
Refueling Maintenance	980	Yes	Yes	DPDO, Oil/water separator, Boiler

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
McCONNELL AFB

Name	Location (Bldg. No.)	Hazardous Materials	Hazardous Wastes	Typical Storage, Treatment Disposal Methods
384 Transportation Squadron (Continued)				
Special Purpose Maintenance	1111	Yes	Yes	DPDO, Boiler
384 Air Refueling Wing				
Life Support Shop	1170 and 1182	Yes	No	-
384 Avionics Maintenance				
Auto Pilot Shop	1170	Yes	No	-
Communications Radio	1170	Yes	No	-
Flight Control Instruments	1170	No	No	-
Inertial Navigation	1170	Yes	No	-
Precision Measurement Equipment Lab	1099	Yes	Yes	DPDO
Radar Navigation	1170	Yes	No	-
384 Field Maintenance Squadron				
Aerospace Ground Equipment Shop	1171	Yes	Yes	DPDO, Boiler
Corrosion Control	1169	Yes	Yes	Settling tanks to sanitary sewer, Dumpster

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
McCONNELL AFB

Name	Location (Bldg. No.)	Hazardous Materials	Hazardous Wastes	Typical Storage, Treatment Disposal Methods
384 Field Maintenance Squadron (Continued)				
Electric/Battery Shop	1169 and 1171	Yes	'es	DPDO, Neutralization to sanitary sewer
Engine Conditioning Shop	1169	Yes	Yes	DPDO, Boiler
Environmental Systems	1169	Yes	No	-
Fuel Systems Repair	1166	Yes	Yes	Oil/water separator
Jet Engine Intermediate Maintenance	1169	Yes	Yes	DPDO, Boiler, FPTA
Machine Shop	1169	Yes	No	-
Non-Destructive Inspection	1219	Yes	Yes	DPDO, Silver recovery/ sanitary sewer
Pneudraulic Shop	1169	Yes	Yes	DPDO, Boiler
Repair and Reclamation	1106	Yes	Yes	DPDO, Boiler
Quick Start Auxillary Systems	1169	Yes	Yes	DPDO, FPTA
Structural Repair	1169	Yes	No	-
Survival Equipment	1110	Yes	No	-
Jet Engine Test Cell	1604	Yes	Yes	DPDO, Boiler
Welding Shop	1169	Yes	No	-

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
McCONNELL AFB

Name	Location (Bldg. No.)	Hazardous Materials	Hazardous Wastes	Typical Storage, Treatment Disposal Methods
384 Organizational Maintenance Squadron				
Alert Maintenance	978	No	No	-
Non-Powered AGE	1108	Yes	Yes	DPDO, Boiler, FPTA
Phase Inspection	1106	Yes	No	-
Tanker Inspection	1148	Yes	Yes	Oil/water separator
Transient Alert	1110	Yes	No	-
384 Combat Support Group				
Arts and Crafts (Admin.)	410	No	No	-
Auto Hobby Shop	16	Yes	Yes	Oil/water separator, DPDO
Graphics Shop	1120	Yes	Yes	Silver recovery/ sanitary sewer
Photo Laboratory	1120	Yes	Yes	Silver recovery/ sanitary sewer
Reprographics	732	Yes	No	-
Small Arms Range	1541	Yes	Yes	DPDO, Boiler
Wood Hobby Shop	332	Yes	No	-

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
McCONNELL AFB

Name	Location (Bldg. No.)	Hazardous Materials	Hazardous Wastes	Typical Storage, Treatment Disposal Methods
381 Civil Engineering Squadron				
Carpenter Shop	691	No	No	-
Entomology	1313	Yes	Yes	Held in rinsate tanks
Environmental Support	693	Yes	No	-
Exterior Electric Shop	1210	Yes	Yes	DPDO
Fire Extinguisher Maintenance	1201	Yes	No	-
Golf Course Maintenance	1313	Yes	Yes	DPDO
Heating Shop	699	Yes	No	-
Interior Electric Shop	691	No	No	-
Liquid Fuels Maintenance	990	Yes	Yes	Weathered and landfilled, on site/off site
Masonary Shop	950	No	No	-
Paint Shop	691	Yes	Yes	DPDO, Boiler
Payment and Grounds	692	Yes	No	-
Plumbing Shop	691	Yes	No	-
Power Production	691	Yes	No	-
Refrigeration Shop	691	Yes	No	-
Sheet Metal/Welding	691	Yes	No	-
Heavy Equipment Maintenance	692	Yes	No	-

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
McCONNELL AFB

Name	Location (Bldg. No.)	Hazardous Materials	Hazardous Wastes	Typical Storage, Treatment Disposal Methods
384 Security Police Squadron				
Armory	1098	Yes	No	-
USAF Hospital McConnell				
Clinical Laboratory	212	Yes	No	-
Dental Laboratory	806	Yes	No	-
Dental X-Ray	806	Yes	Yes	Silver recovery/ sanitary sewer
Medical Maintenance	212	Yes	No	-
Surgery (Administration)	212	No	No	-
Radiology (Medical X-Ray)	212	Yes	Yes	Silver recovery/ sanitary sewer
2155 Information Systems Squadron				
Antenna Maintenance	1170	Yes	No	-
Closed Circuit TV	1170	Yes	No	-
Computer Maintenance	1170/750	Yes	No	-
Data Automation	515	Yes	No	-
Intra-Base Radio	1170	Yes	No	-
IRCS Radio Maintenance	1170	Yes	No	-

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
McCONNELL AFB

Name	Location (Bldg. No.)	Hazardous Materials	Hazardous Wastes	Typical Storage, Treatment Disposal Methods
2155 Information Squadron (Continued)				
Missile Control Systems	1170	Yes	No	-
NAV/AIDS Maintenance	1170/1407	Yes	No	-
Teletype Maintenance (Admin)	1170	No	No	-
TPS-39 Radar Maintenance	1170	Yes	No	-
TRACALS (ATC Radio) Maintenance	1560	Yes	No	-
Weather Maintenance	1501	Yes	No	-
HF/UHF Radio Maintenance	1170	Yes	No	-
Radar Maintenance	1703/1706	Yes	No	-
127 Tactical Fighter Squadron				
Life Support Shop	48	Yes	No	-
Flight Simulator		No	No	-
184 Civil Engineering Squadron				
Mechanical Shop	15	Yes	Yes	DPDO, Boiler
Structural Shop	15	Yes	No	-

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
McCONNELL AFB

Name	Location (Bldg. No.)	Hazardous Materials	Hazardous Wastes	Typical Storage, Treatment Disposal Methods
184 Combat Support Squadron				
Photo Laboratory	41	Yes	Yes	Silver recovery/ sanitary sewer
Reproductions	35	Yes	No	-
184 Consolidated Aircraft Maintenance Squadron				
Aerospace Ground Equipment	46	Yes	Yes	DPDO
Auto-Pilot Shop	49	Yes	No	-
COMM/NAV Shop	49	Yes	No	-
Corrosion Control Shop	39 and 1128	Yes	Yes	DPDO, Dumpsters
Egress Shop	41	Yes	No	-
Electric Shop	41	Yes	No	-
Jet Engine Shop	37	Yes	Yes	DPDO, Boiler
Environmental Systems	41	Yes	No	-
Fuel System Repair	1129	Yes	Yes	FPTA, DPDO, Sanitary sewer
Gun Services	49	Yes	Yes	DPDO, Boiler
Machine Shop	41	Yes	No	-

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
McCONNELL AFB

Name	Location (Bldg. No.)	Hazardous Materials	Hazardous Wastes	Typical Storage, Treatment Disposal Methods
184 Consolidated Aircraft Maintenance Squadron (Continued)				
Munitions Shop	47	Yes	No	-
Parachute Shop	48	Yes	No	-
Phase Inspection	41	Yes	Yes	DPDO, Boiler
Sheet Metal	41	Yes	No	-
Weapons Control System	49	Yes	No	-
Weapons Loading	49	Yes	No	-
Weapons Release	49	Yes	Yes	DPDO, Boiler
Welding Shop	41	Yes	No	-
Wheel and Tire Shop	41	Yes	Yes	DPDO, Boiler
Hydraulics Shop	41	Yes	Yes	DPDO, Boiler
Electronic Counter Measures	49	Yes	No	-
184 Tactical Clinic				
Dental X-Ray	35	Yes	Yes	Silver recovery/ sanitary sewer
Medical X-Ray	35	Yes	Yes	Silver recovery/ sanitary sewer

MASTER LIST OF INDUSTRIAL SHOPS
McCONNELL AFB

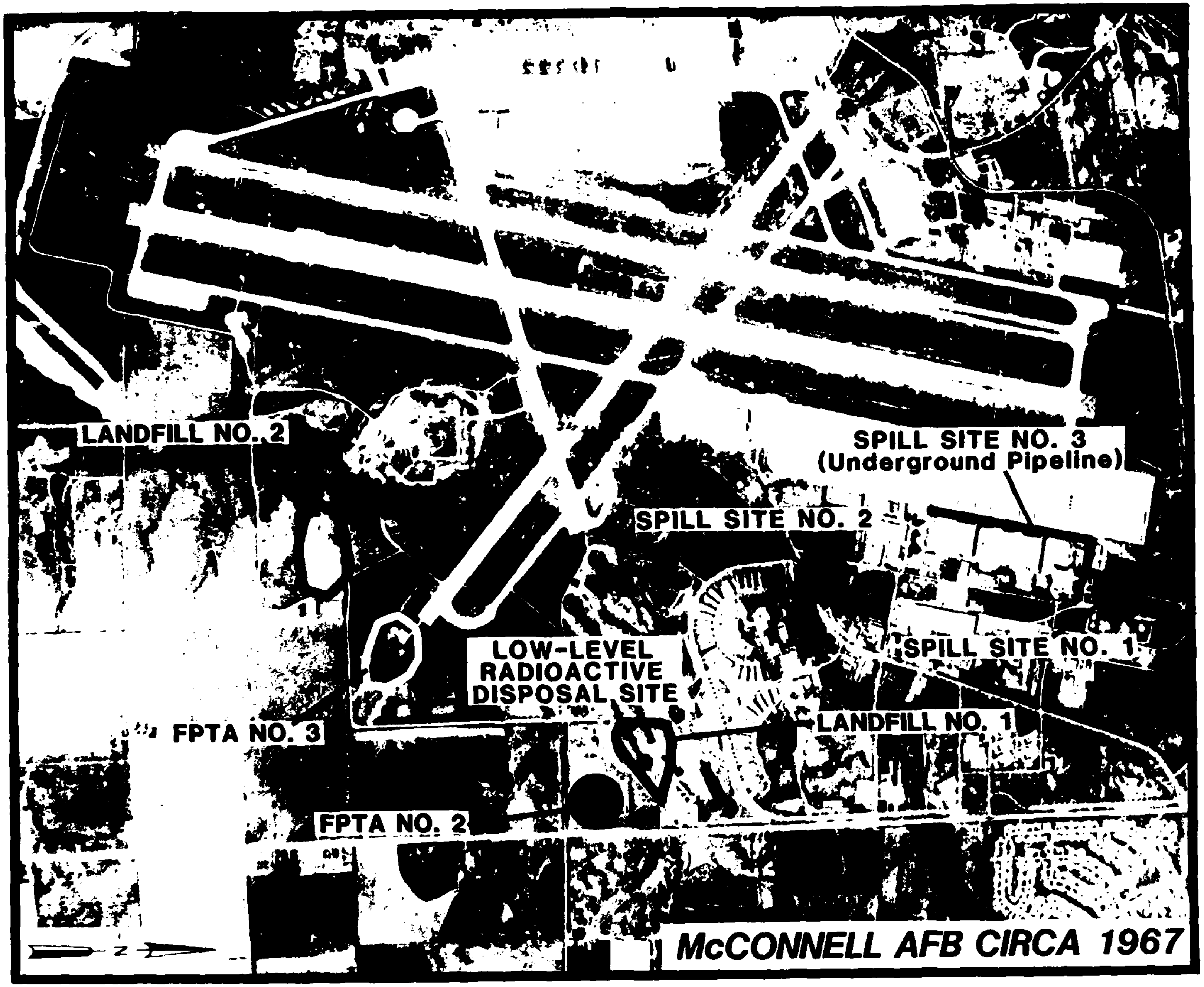
Name	Location (Bldg. No.)	Hazardous Materials	Hazardous Wastes	Typical Storage, Treatment Disposal Methods
184 Resource Management Squadron				
Motor Pool	43	Yes	Yes	DPDO, Boiler
Packing and Crating Section	42	Yes	No	-
Data Processing	17	Yes	No	-
Tactical Control Flight				
TAC Control	Trailers	No	No	-
Communications Maintenance	9004	Yes	No	-
Defense Logistics Agency				
Defense Property Disposal Office	1348/1349	Yes	No	-
Det. 3, 47 Flying Wing				
T-37 Maintenance Section	1218	Yes	Yes	DPDO, Boiler

APPENDIX E
MASTER LIST OF INDUSTRIAL SHOPS
McCONNELL AFB

Name	Location (Bldg. No.)	Hazardous Materials	Hazardous Wastes	Typical Storage, Treatment Disposal Methods
Det. 6, 27 Air Reserve Recovery Squadron				
Helicpoter Maintenance	1218	Yes	Yes	DPDO, Boiler
Det. 23, 26 Weather Squadron				
Weather Shop	1112	Yes	No	-
Smoky Hill Weapons Range				
Civil Engineering (Inactive)	6001	Yes	No	-
Communications Maintenance	4001	Yes	No	-
Motor Pool	6001	Yes	Yes	Dumpsters, DPDO
Target Maintenance	4001	Yes	No	-
Heavy Equipment Maintenance (Inactive)	4001	Yes	No	-

APPENDIX F

PHOTOGRAPHS



ES ENGINEERING-SCIENCE

McCONNELL AFB

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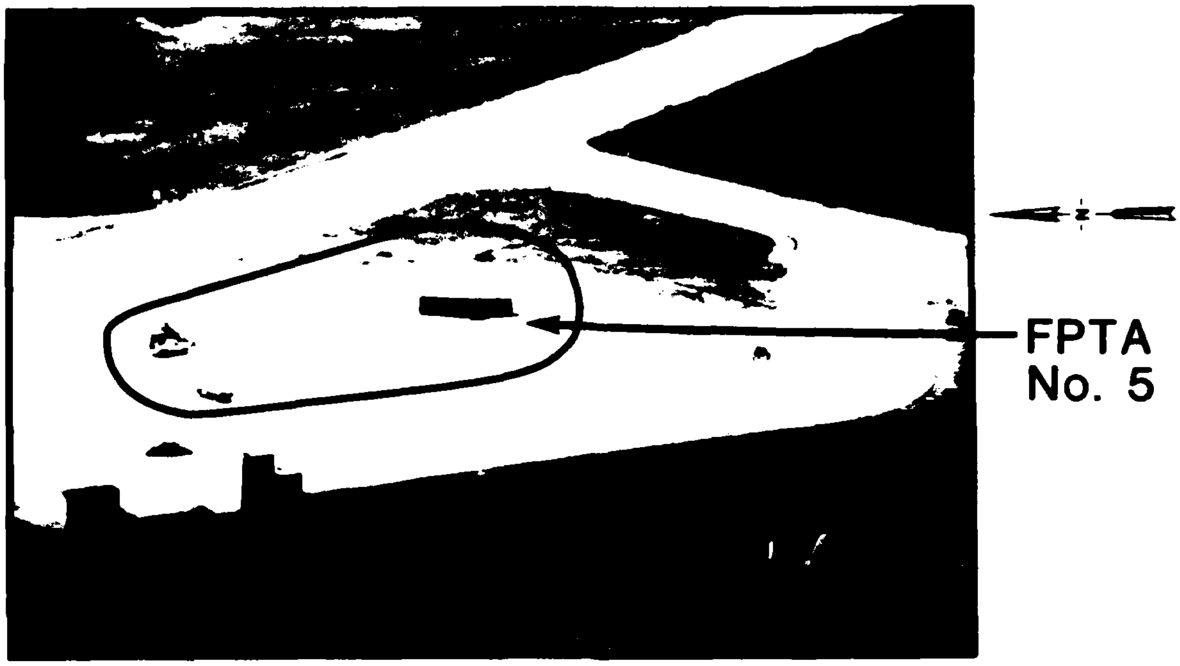

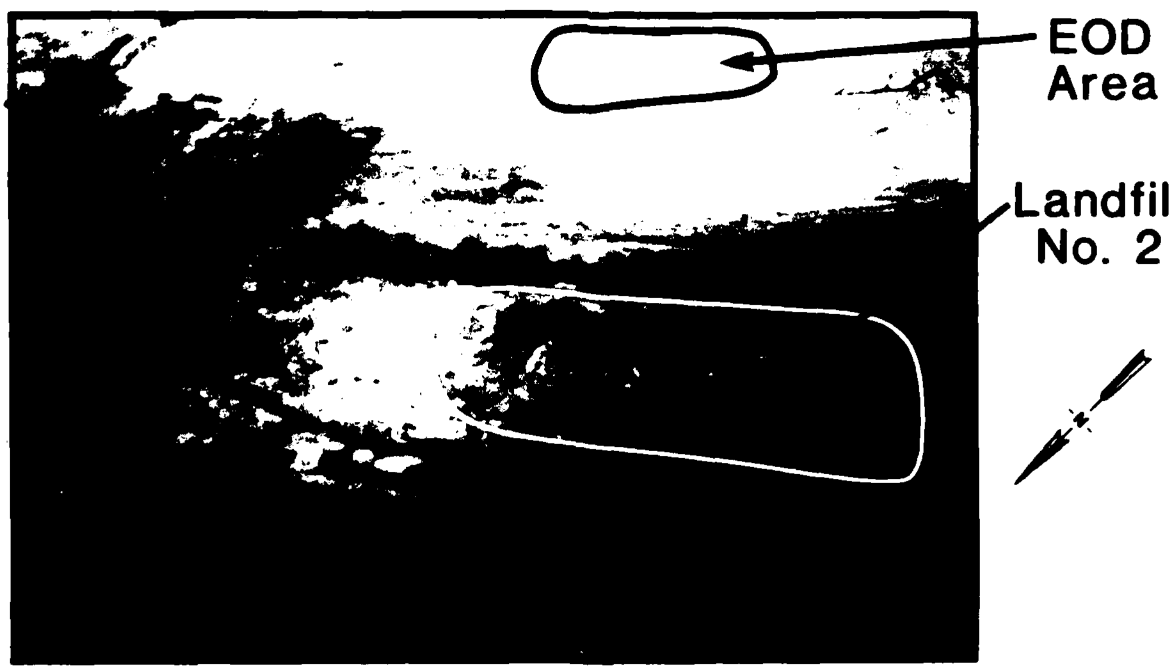

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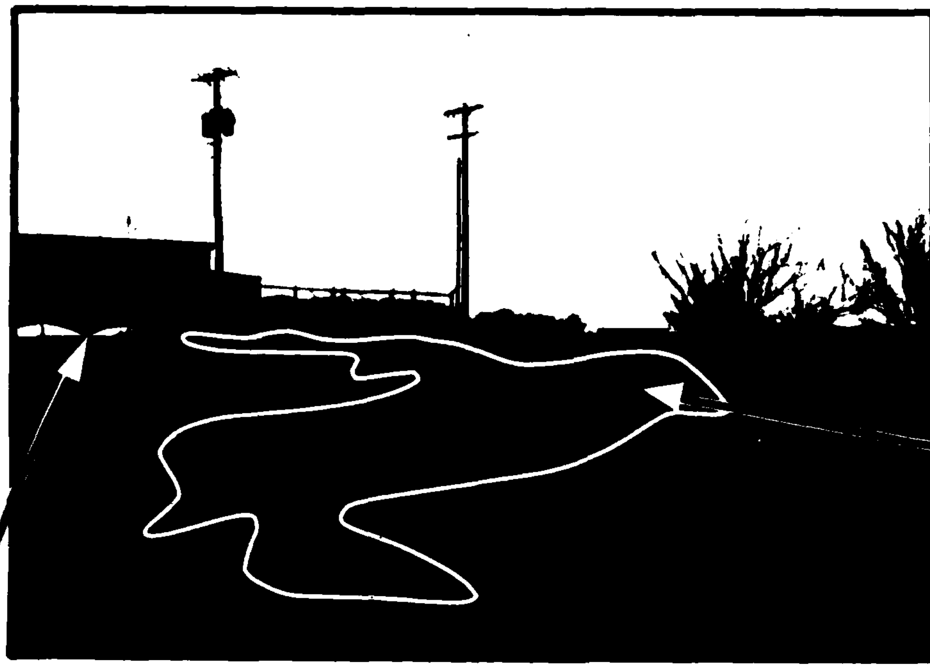
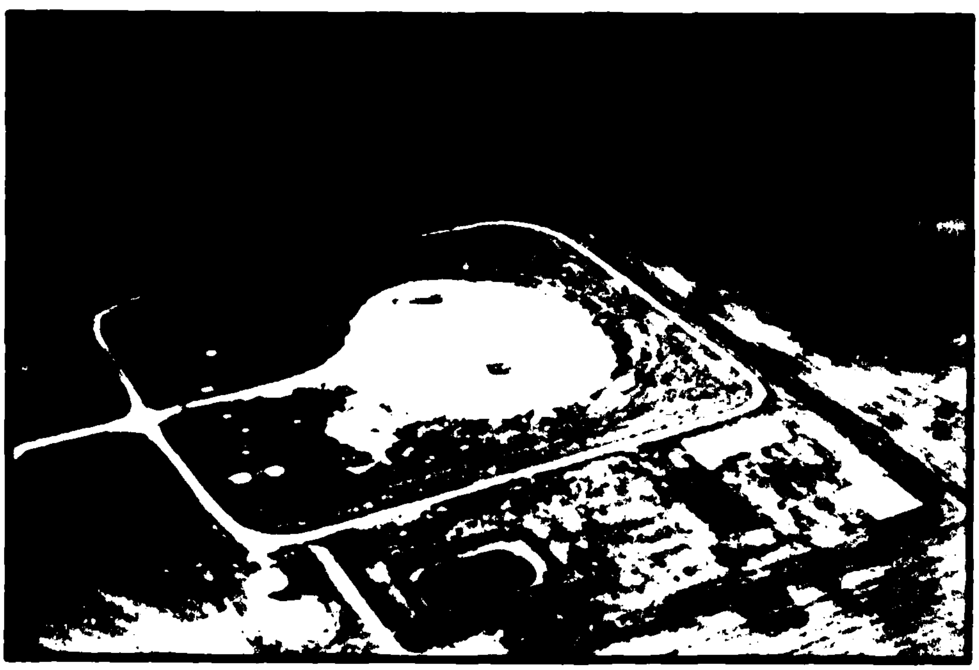
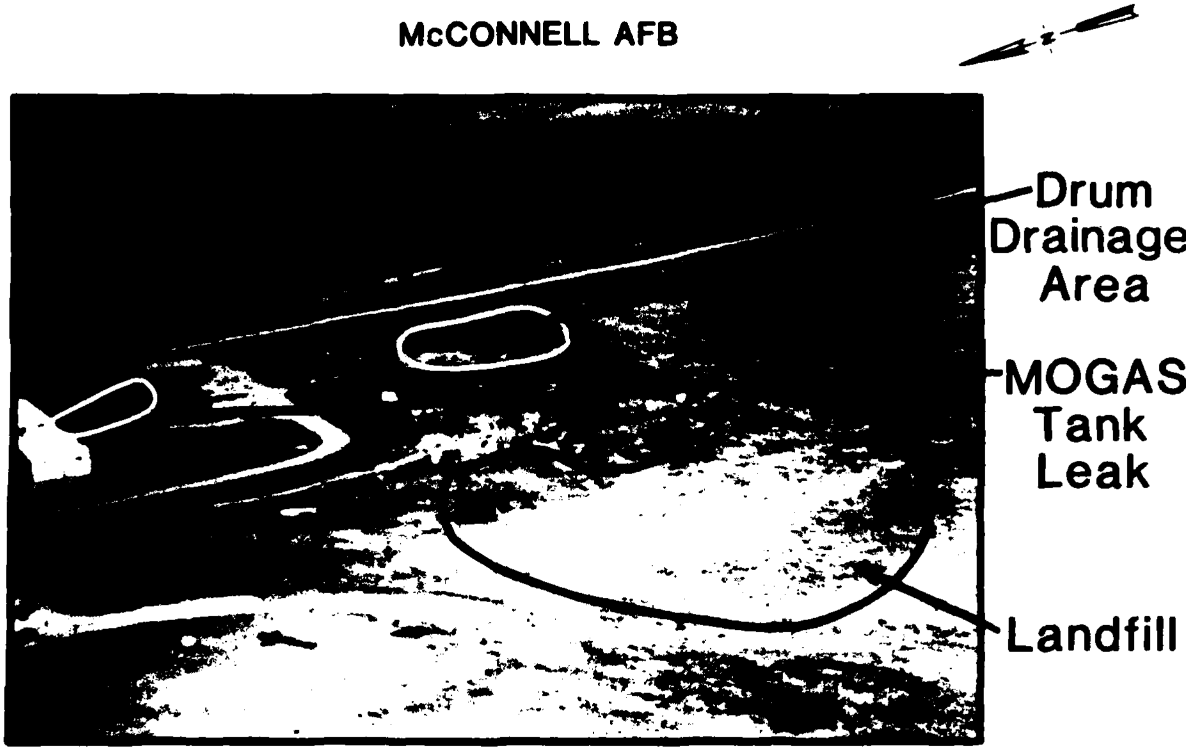


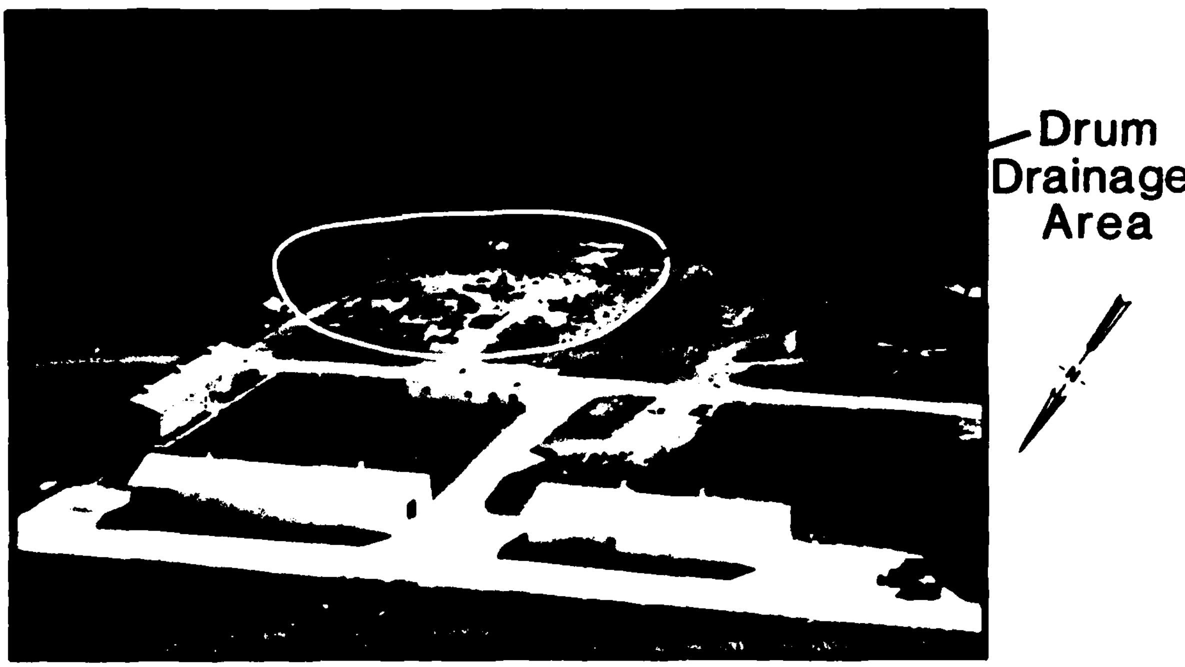


Titan Site 3-7

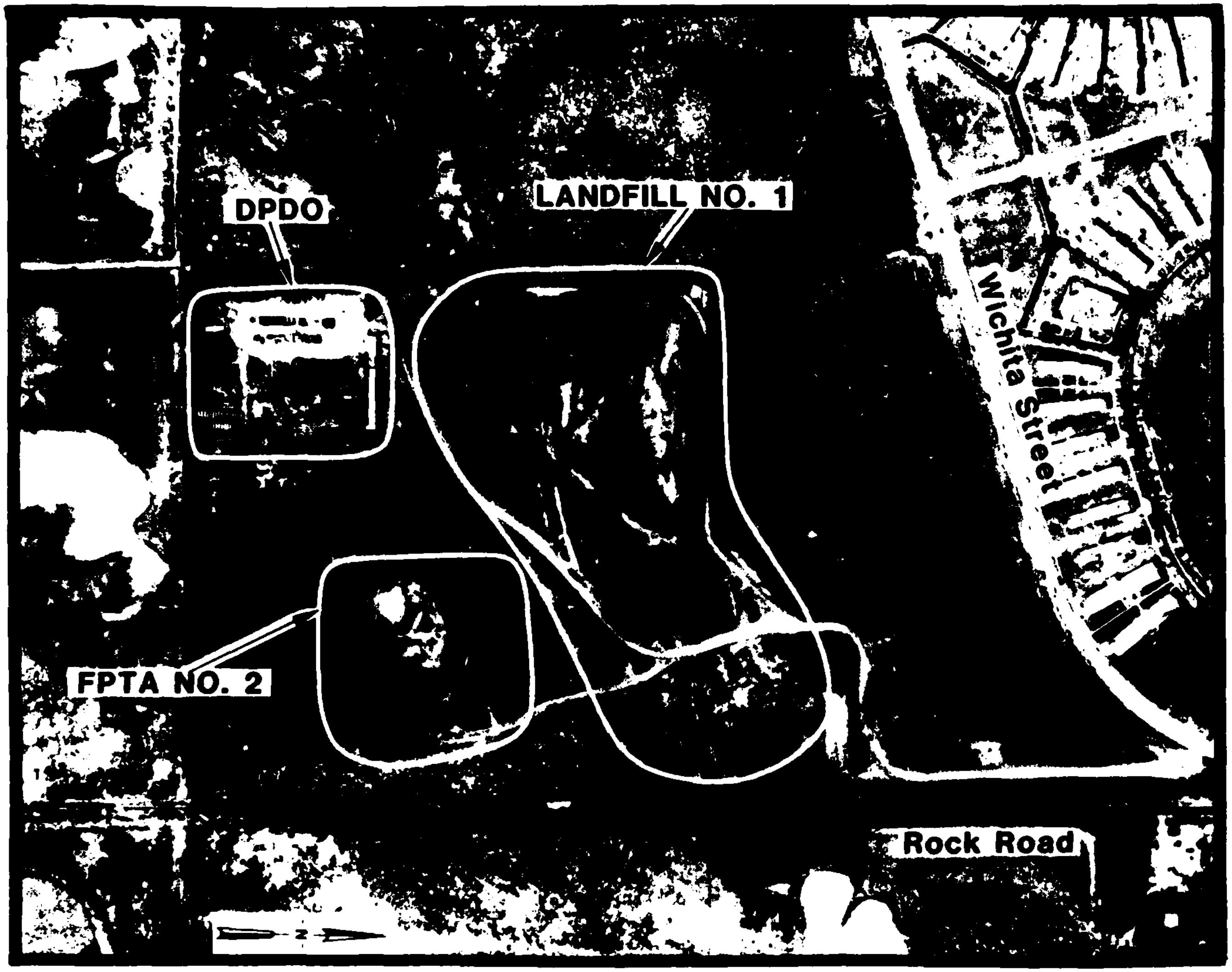
McCONNELL AFB



Smoky Hill Weapons Range Headquarters



Smoky Hill Weapons Range Headquarters - Drum Drain Area



McCONNELL AFB CIRCA 1959

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLOGY

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM
HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

The Department of Defense (DOD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DOD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Records Search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with represenatives from USAF Occupational and Environmental Health Laboratory (OEHL), Air Force Engineering and Services Center (AFESC), Engineering-Science (ES) and CH2M Hill. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, Engineering-Science, and CH2M Hill met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of the IRP.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DOD program needs.

The model uses data readily obtained during the Records Search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the policy for evaluating and setting restrictions on excess DOD properties.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, potential pathways for waste contaminant migration, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant and adding the weighted scores to obtain a total category score.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface water migration, flooding, and ground-water migration. Evaluation of each route involves factors associated with the particular migration route. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The scores for each of the three categories are then added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Sites at which there is no containment are not reduced in score. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

FIGURE 1

HAZARD ASSESSMENT RATING METHODOLOGY FLOW CHART

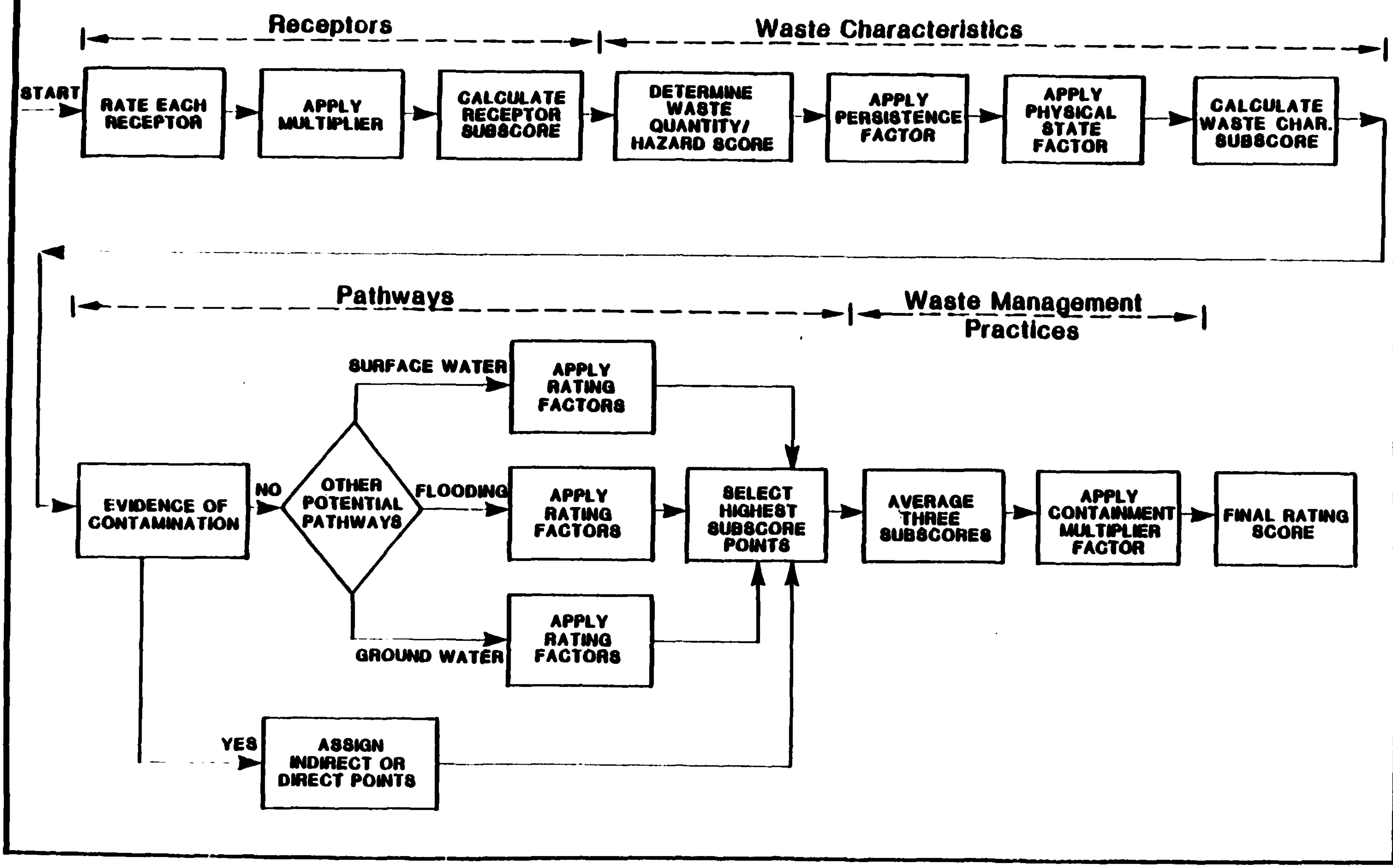


FIGURE 2

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE ______

LOCATION ______

DATE OF OPERATION OR OCCURRENCE ______

OWNER/OPERATOR ______

COMMENTS/DESCRIPTION ______

SITE RATED BY ______

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to reservation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		
		Subtotals	______	______

Receptors subscore (100 X factor score subtotal/maximum score subtotal) ______

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______
2. Confidence level (C = confirmed, S = suspected) ______
3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix) ______

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

FIGURE 2 (Continued)

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		

Subtotals ______ ______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding		1		

Subscore (100 x factor score/3) ______

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		3		
Subsurface flows		8		
Direct access to ground water		8		

Subtotals ______ ______

Subscore (100 x factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, 3-1, 3-2 or 3-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = ______

TABLE 1

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1 - 25	26 - 100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1 mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or Industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1 mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination.	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands.	10
F. Water quality/use designation of nearest surface water body	Agricultural or Industrial use.	Recreation, propagation and management of fish and wildlife.	Shellfish propagation and harvesting.	Potable water supplies	6
G. Ground-Water use of uppermost aquifer	Not used, other sources readily available.	Commercial, industrial, or irrigation, very limited other water sources.	Drinking water, municipal water available.	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available.	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1 - 50	51 - 1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1 - 50	51 - 1,000	Greater than 1, 000	6

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (<5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (>20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records.
- o Knowledge of types and quantities of wastes generated by shops and other areas on base.
- o Based on the above, a determination of the types and quantities of waste disposed of at the site.

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records.
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site.

A-3 Hazard Rating

Hazard Category	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:
Confidence Level
- o Confirmed confidence levels (C) can be added
- o Suspected confidence levels (S) can be added
- o Confirmed confidence levels cannot be added with suspected confidence levels

Waste Hazard Rating
- o Wastes with the same hazard rating can be added
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 POTENTIAL FOR SURFACE WATER CONTAMINATION

Rating Factor	Rating Scale Levels 0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 in.	-10 to + 5 in.	+5 to +20 in.	Greater than +20 in.	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1 year 24-hr rainfall	<1.0 inch	1.0-2.0 inches	2.1-3.0 inches	>3.0 inches	8

B-2 POTENTIAL FOR FLOODING

Rating Factor	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 25-year floodplain	In 10-year floodplain	Floods annually	1

B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION

Rating Factor	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 ft	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 in.	-10 to +5 in.	+5 to +20 in.	Greater than +20 in.	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casings, subsidence fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. WASTE MANAGEMENT PRACTICES FACTOR

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Fire Proection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1 or III-B-3, then leave blank for calculation of factor score and maximum possible score.

APPENDIX H

SITE HAZARD ASSESSMENT RATING FORMS

APPENDIX H

INDEX FOR HAZARDOUS ASSESSMENT

METHODOLOGY FORMS

Landfill No. 1	H-1
SHWR Headquarters Disposal Site	H-3
FPTA No. 2	H-5
FPTA No. 3	H-7
Landfill No. 2	H-9
Spill Site No. 3	H-11
FPTA No. 1 & No. 5	H-13
Spill Site No. 1	H-15
Low-Level Radioactive Waste	H-17
Spill Site No. 2	H-19
Missile Site 3-2	H-21
Spill Site No. 4	H-23

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Landfill No. 1
Location: South of golf course club house
Date of Operation: 1953 to 1960
Owner/Operator: McConnell AFB
Comments/Description: Trench and fill, daily burning and cover, includes POL tank sludge

Site Rated by: J.R.Butner; R.D.Stephens; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			70	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 39

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) L = large
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 1.00 = 100

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.00 = 100

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			74	108
Subscore (100 x factor score subtotal/maximum score subtotal)				69
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			16	114
Subscore (100 x factor score subtotal/maximum score subtotal)				14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 69

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		39	
Waste Characteristics		100	
Pathways		69	
Total	207	divided by 3 =	69 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

69 x 1.00 = 69

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Smoky Hill Headquarters Disposal Site
Location: Headquarters complex Smoky Hill weapons range
Date of Operation: 1946 to present
Owner/Operator: Kansas Air National Guard
Comments/Description: Landfill, drum drain area, Mogas spill

Site Rated by: J.R.Butner; R.D.Stephens; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			94	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 52

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) L = large
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.90 = 90

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

90 x 1.00 = 90

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			54	108
Subscore (100 x factor score subtotal/maximum score subtotal)				50
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			32	114
Subscore (100 x factor score subtotal/maximum score subtotal)				28

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 50

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		52	
Waste Characteristics		90	
Pathways		50	
Total	192	divided by 3 =	64 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

64 x 1.00 = \ 64 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Fire Protection Training Area No. 2
Location: South of golf course driving range
Date of Operation: 1958 to 1962
Owner/Operator: McConnell AFB
Comments/Description: Earth pit, no prewetting

Site Rated by: J.R.Butner; R.D.Stephens; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			66	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 37

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) L = large
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.90 = 90

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

90 x 1.00 = 90

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			66	108
Subscore (100 x factor score subtotal/maximum score subtotal)				61
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			16	114
Subscore (100 x factor score subtotal/maximum score subtotal)				14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 61

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		37		
Waste Characteristics		90		
Pathways		61		
Total	188	divided by 3 =	63	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

63 x 1.00 = 63

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Fire Protection Training Area No. 3
Location: South of building 1318
Date of Operation: 1963 to 1971
Owner/Operator: McConnell AFB
Comments/Description: Earth pit, no prewetting

Site Rated by: J.R.Butner; R.D.Stephens; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			59	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 33

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) L = large
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.90 = 90

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

90 x 1.00 = 90

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			66	108
Subscore (100 x factor score subtotal/maximum score subtotal)				61
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			16	114
Subscore (100 x factor score subtotal/maximum score subtotal)				14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 61

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	33	
Waste Characteristics	90	
Pathways	61	
Total 184	divided by 3 =	61 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

61 x 1.00 = \ 61 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Landfill No. 2
Location: Adjacent to small arms range, south of EOD area
Date of Operation: 1960 to 1970
Owner/Operator: McConnell AFB
Comments/Description: Trench and fill, daily burning and cover

Site Rated by: J.R.Butner; R.D.Stephens; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			63	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 35

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) L = large
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.80 = 80

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

80 x 1.00 = 80

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			74	108
Subscore (100 x factor score subtotal/maximum score subtotal)				69
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			16	114
Subscore (100 x factor score subtotal/maximum score subtotal)				14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 69

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		35		
Waste Characteristics		80		
Pathways		69		
Total	184	divided by 3 =	61	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

61 x 1.00 = \ 61 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Spill Site No. 3
Location: Along flightline underground fuel line
Date of Operation: 1954 to 1963
Owner/Operator: McConnell AFB
Comments/Description:

Site Rated by: J.R.Butner; R.D.Stephens; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi- plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			70	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 39

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 1.00 = 80

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

80 x 1.00 = 80

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			66	108
Subscore (100 x factor score subtotal/maximum score subtotal)				61
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			16	114
Subscore (100 x factor score subtotal/maximum score subtotal)				14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 61

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	39	
Waste Characteristics	80	
Pathways	61	
Total 180 divided by 3 =		60 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

60 x 1.00 = 60

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Fire Protection Area No.1 and No.5
Location: Runway apron between taxiway 2 and taxiway 4
Date of Operation: 1972 to present (No.5); 1954 to 1957 (No.1)
Owner/Operator: McConnell AFB
Comments/Description: Earth pit, two burn areas (No.1), trench burns (No.1) prewetting (No.5)
Site Rated by: J.R.Butner; R.D.Stephens; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			61	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 34

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) L = large
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.90 = 72

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

72 x 1.00 = 72

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			74	108
Subscore (100 x factor score subtotal/maximum score subtotal)				69
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			16	114
Subscore (100 x factor score subtotal/maximum score subtotal)				14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 69

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		34	
Waste Characteristics		72	
Pathways		69	
Total	174	divided by 3 =	58 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

58 x 1.00 = \ 58 \

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Spill Site No. 1
Location: POL bulk fuel storage area
Date of Operation: 1982
Owner/Operator: McConnell AFB
Comments/Description: Bulk fuel tank,11,000 gallons JP-4 lost to perculation/ evaporation
Site Rated by: J.R.Butner; R.D.Stephens; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			70	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 39

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) M = medium
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.80 = 64

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

64 x 1.00 = 64

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			74	108
Subscore (100 x factor score subtotal/maximum score subtotal)				69
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			16	114
Subscore (100 x factor score subtotal/maximum score subtotal)				14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 69

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		39
Waste Characteristics		64
Pathways		69
Total	171	divided by 3 = 57 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

57 x 1.00 = 57

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Low - Level Radioactive Waste Disposal Area
Location: West of Muluane Road, on golf course
Date of Operation: 1965 to 1968
Owner/Operator: McConnell AFB
Comments/Description: Low level radioactive electronics tubes

Site Rated by: J.R.Butner; R.D.Stephens; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			59	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 33

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.00 = 60

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.00 = 60

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			74	108
Subscore (100 x factor score subtotal/maximum score subtotal)				69
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			16	114
Subscore (100 x factor score subtotal/maximum score subtotal)				14

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 69

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		33
Waste Characteristics		60
Pathways		69
Total	161 divided by 3 =	54 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

54 x 1.00 = 54

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Missile Site 3-2
Location:
Date of Operation: 1983
Owner/Operator: McConnell AFB
Comments/Description: 2000 gallons diesel fuel lost, rupture in transfer line

Site Rated by: J.R.Butner; R.D.Stephens; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to installation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			81	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 45

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.80 = 48

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 1.00 = 48

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	2	6	12	18
Rainfall intensity	2	8	16	24
Subtotals			60	108
Subscore (100 x factor score subtotal/maximum score subtotal)				56
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 56

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		45	
Waste Characteristics		48	
Pathways		56	
Total	149	divided by 3 =	50 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

50 x 1.00 = 50

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Spill Site No. 2
Location: Base service station
Date of Operation: 1984 to 1985
Owner/Operator: McConnell AFB
Comments/Description: 3,000 gallons of Mogas fuel spill

Site Rated by: J.R.Butner; R.D.Stephens; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			64	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 36

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.80 = 48

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 1.00 = 48

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	2	8	16	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			74	108
Subscore (100 x factor score subtotal/maximum score subtotal)				69
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			16	114
Subscore (100 x factor score subtotal/maximum score subtotal)				14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 69

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		36	
Waste Characteristics		48	
Pathways		69	
Total	152	divided by 3 =	51 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

51 x 1.00 = 51

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of site: Spill Site No. 4
Location: South of building 1313
Date of Operation: 1980 to 1985
Owner/Operator: McConnell AFB
Comments/Description: Pesticide rinsewater tanks

Site Rated by: J.R.Butner; R.D.Stephens; J.R.Absalon

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to installation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	1	9	9	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			53	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 29

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (small, medium, or large) S = small
2. Confidence level (confirmed or suspected) C = confirmed
3. Hazard rating (low, medium, or high) H = high

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.00 = 60

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.00 = 60

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			58	108
Subscore (100 x factor score subtotal/maximum score subtotal)				54
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			16	114
Subscore (100 x factor score subtotal/maximum score subtotal)				14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 54

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		29	
Waste Characteristics		60	
Pathways		54	
Total	143	divided by 3 =	48 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

48 x 1.00 = 48

FINAL SCORE

APPENDIX I

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

APPENDIX I

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

ABG: Air Base Group.

ACFT MAINT: Aircraft Maintenance.

AF: Air Force.

AFB: Air Force Base.

AFCS: Air Force Communications Service.

AFESC: Air Force Engineering and Services Center.

AFFF: Aqueous Film Forming Foam, a fire extinquishing agent. AFFF concentrates include fluorinated surfactants plus foam stabilizers diluted with water to a 3 to 6% solution.

AFR: Air Force Regulation.

AFS: Air Force Station.

Ag: Chemical symbol for silver.

AGE: Aerospace Ground Equipment.

Al: Chemical symbol for aluminum.

ALLUVIAL: Unconsolidated (usually) materials deposited in a stream valley by the action of flowing waters. Sand and gravel zones, deltaic materials, etc. may be alluvial deposits. An alluvial valley is the total area in which a flowing stream may deposit materials.

ALLUVIUM: Materials eroded, transported and deposited by streams.

AMS: Avionics Maintenance Squadron

ANG: Air National Guard.

AQUIFER: A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.

AQUITARD: A geologic unit which impedes ground-water flow.

AREFW: Air Refueling Wing.

ARRS: Aerospace Rescue and Recovery Squadron

ARTESIAN: Ground water contained under hydrostatic pressure.

ASC: Audiovisual Service Center.

ATC: Air Training Command.

AVGAS: Aviation Gasoline.

Ba: Chemical symbol for barium.

BEDROCK: Any solid rock exposed at the surface of the earth or overlain by unconsolidated material.

BEE: Bioenvironmental Engineer.

BES: Bioenvironmental Engineering Section.

BIOACCUMULATE: Tendency of elements or compounds to accumulate or build up in the tissues of living organisms when they are exposed to these elements in their environments, e.g., heavy metals.

BIODEGRADABLE: The characteristic of a substance to be broken down from complex to simple compounds by microorganisms.

BOWSER: A portable tank, usually under 200 gallons in capacity.

BX: Base Exchange.

CAMS: Consolidated Aircraft Maintenance Squadron.

Cd: Chemical symbol for cadmium.

CE: Civil Engineering.

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act.

CES: Civil Engineering Squadron.

CIRCA: About; used to indicate an approximate date.

CLOSURE: The completion of a set of rigidly defined functions for a hazardous waste facility no longer in operation.

CN: Chemical symbol for cyanide.

COD: Chemical Oxygen Demand, a measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water.

COE: Corps of Engineers.

COLLUVIUM: Sediments that have moved down slope primarily under the influence of gravity or as periodic, unchannelized flow. It frequently includes large boulders or other fragments which contrast this matrial to alluvium, material deposited by channelized flow which results in some degree of sorting according to particle size.

CONFINED AQUIFER: An aquifer bounded above and below by impermeable strata or by geologic units of distinctly lower permeability than that of the aquifer itself.

CONFINING UNIT: An aquitard or other poorly permeable layer which restricts the movement of ground water.

CONSOLIDATED: A solid (lithified) material, such as bedrock. Examples include shale, sandstone, siltstone, conglomerate, granite, schist, gneiss, volcanic rocks, etc. Consolidated materials are solid due to the diagenetic changes that the constituent parts have undergone or due to the initial environment in which the stratum formed.

CONTAMINATION: The degradation of natural water quality to the extent that its usefulness is impaired; there is no implication of any specific limits since the degree of permissible contamination depends upon the intended end use or uses of the water.

Cr: Chemical symbol for chromium.

CRS: Component Repair Squadron.

CSG: Combat Support Group.

Cu: Chemical symbol for copper.

DET: Detachment.

DISPOSAL FACILITY: A facility or part of a facility at which hazardous waste is intentionally placed into or on land or water, and at which waste will remain after closure.

DISPOSAL OF HAZARDOUS WASTE: The discharge, deposit, injection, dumping, spilling, or placing of any hazardous waste into or on land or water so that such waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground water.

DOD: Department of Defense.

DOWNGRADIENT: In the direction of decreasing hydraulic static head; the direction in which ground water flows.

DPDO: Defense Property Disposal Office, previously included Redistribution and Marketing (R&M) and Salvage.

DUMP: An uncovered land disposal site where solid and/or liquid wastes are deposited with little or no regard for pollution control or aesthetics; dumps are susceptible to open burning and are exposed to the elements, disease vectors and scavengers.

EFFLUENT: A liquid waste discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment.

ELECTRICAL RESISTIVITY (ER): Specialized equipment designed to produce an electrical current through subsurface geologic strata. The instrument and the technique permit the operator to examine conditions at specific depths below land surface. Subsurface contrasts indicative of specific geologic or hydrologic conditions may be obtained through correlation of the ER data with known site information such as that provided by test borings or well construction logs.

EMS: Equipment Maintenance Squadron.

ENVIRONS: Near to ; locally. Refers to the space or zone adjacent to a study area or some special place of interest.

EOD: Explosive Ordnance Disposal.

EP: Extraction Procedure, the EPA's standard laboratory procedure for leachate generation.

EPA: U.S. Environmental Protection Agency.

EPHEMERAL: Short-lived or temporary.

EROSION: The wearing away of land surface by wind, water, or chemical processes.

ES: Engineering-Science, Inc.

FACILITY (As Applied to Hazardous Wastes): Any land and appurtenances thereon and thereto used for the treatment, storage and/or disposal of hazardous wastes.

FAULT: A fracture in rock along which the adjacent rock surfaces are differentially displaced.

Fe: Chemical symbol for iron.

FLOOD PLAIN: The lowland and relatively flat areas adjoining inland and coastal areas of the mainland and off-shore islands, including, at a minimum, areas subject to a one percent or greater chance of flooding in any given year.

FLOW PATH: The direction or movement of ground water as governed principally by the hydraulic gradient.

FMS: Field Maintenance Squadron.

FPTA: Fire Protection Training Area.

FTA: Fire Training Area.

GC/MS: Gas chromatograph/mass spectrophotometer, a laboratory procedure for identifying unknown compounds.

GEOPHYSICS: (Geophysical survey) the use of one or more geophysical instruments or methods to measure specific properties of the earth's subsurface through indirect means. Geophysical equipment may include electrical resistivity, geiger counter, magnetometer, metal detector, electromagnetic conductivity, magnetic susceptibility, etc. Geophysics seeks to provide specific measurements of the earth's magnetic field, the electrical properties of specific geologic strata, radioactivity, etc.

GLACIAL TILL: Unsorted and unstratified drift consisting of clay, sand, gravel and boulders which is deposited by or underneath a glacier.

GROUND WATER: Water beneath the land surface in the saturated zone that is under atmospheric or artesian pressure.

GROUND WATER RESERVOIR: The earth materials and the intervening open spaces that contain ground water.

HALOGEN: The class of chemical elements including fluorine, chlorine, bromine, and iodine.

HARDFILL: Disposal sites receiving construction debris, wood, miscellaneous spoil material.

HARM: Hazard Assessment Rating Methodology.

HAZARDOUS SUBSTANCE: Under CERCLA, the definition of hazardous substance includes:

1. All substances regulated under Paragraphs 311 and 307 of the Clean Water Act (except oil);

2. All substances regulated under Paragraph 3001 of the Solid Waste Disposal Act;

3. All substances regulated under Paragraph 112 of the Clean Air Act;

4. All substances which the Administrator of EPA has acted against under Paragraph 7 of the Toxic Substance Control Act;

5. Additional substances designated under Paragraph 102 of CERCLA.

HAZARDOUS WASTE: As defined in RCRA, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical,

chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

HAZARDOUS WASTE GENERATION: The act or process of producing a hazardous waste.

HEAVY METALS: Metallic elements, including the transition series, which include many elements required for plant and animal nutrition in trace concentrations but which become toxic at higher concentrations.

Hg: Chemical symbol for mercury.

HQ: Headquarters.

HWAP: Hazardous Waste Accumulation Point.

HWMF: Hazardous Waste Management Facility.

ICBM: Intercontinential Ballistic Missile

ILS: Instrument Landing System

INFILTRATION: The movement of water through the soil surface into the ground.

IRP: Installation Restoration Program.

JP-4: Jet Propulsion Fuel Number Four; contains both kerosene and gasoline fractions.

LANDFILL: A land disposal site used for disposing solid and semi-solid materials. May refer either to a sanitary landfill or dump.

LEACHATE: A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water.

LEACHING: The process by which soluble materials in the soil, such as nutrients, pesticide chemicals or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

LENTICULAR: A bed or rock stratum or body that is lens-shaped.

LINER: A continous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents or leachate.

LITHOLOGY: The description of the physical character of a rock.

LOESS: An essentially unconsolidated unstratified calcareous silt; commonly homogeneous, permeable and buff to gray in color.

MAC: Military Airlift Command.

MAGNETOMETER (MG): A device capable of measuring localized variations in the earth's magnetic field that may be due to disturbed areas such as backfilled trenches, buried objects, etc. Measurements may be obtained at points located on a grid pattern so that the data can be contoured, revealing the location, size and intensity of the suspected anomaly.

MAINT: Recording System Maintenance.

MANTLE (MANTLED): Covered or overlain by. For example: "A soil layer mantles bedrock." In this example, a soil stratum overlies the bedrock in a given study area. No attempt is made to interpret the thickness or uniformity of the soil overburden.

MATS: Military Air Transport Service.

MAW: Military Airlift Wing.

MEK: Methyl Ethyl Ketone.

METALS: See "Heavy Metals".

METEORIC WATER: Water derived from the atmosphere.

MOGAS: Motor gasoline.

Mn: Chemical symbol for manganese.

MONITORING WELL: A well used to measure ground-water levels and to obtain ground-water samples for water quality analyses. As distinguished from observation wells, monitoring wells are often designed for longer term operations. They are constructed of materials for the site-specific climatic, hydrogeologic and contaminant conditions.

MSL: Mean Sea Level.

MUNITION ITEMS: Munitions or portions of munitions having an explosive potential.

MUNITIONS RESIDUE: Non-explosive segments of waste munitions (i.e., bomb casings).

NCO: Non-commissioned Officer.

NCOIC: Non-commissioned Officer In-Charge.

NDI: Non-destructive Inspection.

NET PRECIPITATION: The amount of annual precipitation minus annual evaporation.

NGVD: National Geodetic Vertical Datum of 1929. A national datum system, tied to Mean Sea Level, but referenced primarily to land-based benchmarks.

Ni: Chemical symbol for nickel.

NOAA: National Oceanic and Atmospheric Administration.

NPDES: National Pollutant Discharge Elimination System.

OBSERVATION WELL: An informally designed cased well, open to a specific geologic unit or formation, designed to allow the measurement of physical ground-water properties within the zone or unit of interest. Observation wells are designed to permit the measurement of water levels and in-situ parameters such as ground-water (flow velocity and flow direction. Not to be confused with a monitoring well, a well designed to permit accurate ground-water quality monitoring. Monitoring wells are constructed of materials compatible with site-specific climatic, hydrogeologic and contaminant conditions. monitoring well installation and construction is planned to have minimal impacts on apparent ground-water quality and will often be for longer term operation compared with observation wells.

OEHL: USAF Occupational and Environmental Health Laboratory.

OIC: Officer-In-Charge.

OMS: Organizational Maintenance Squadron.

OPNS: Operations.

OSI: Office of Special Investigations.

O&G: Symbols for oil and grease.

OUT CROP: Zone or area of exposure where a geologic unit or formation occurs at or near land surface. "Outcrop area" is an important factor in hydrogeologic studies as this zone usually corresponds to the point where significant recharge occurs. When this term is used as an intransitive verb: "Where the unit crops out....."

OVA: Organic Vapor Analysis.

OXIDIZER: Material necessary to support combustion of fuel.

Pb: Chemical symbol for lead.

PCB: Polychlorinated Biphenyl; liquids used as a dielectrics in electrical equipment.

PD-680: Cleaning solvent; petroleum distillate, Stoddard solvent.

PERCOLATION: Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.

PERMEABILITY: The relative rate of water flow through a porous medium. The USDA, Soil Conservation Service describes permeability qualitatively as follows:

very slow	<0.06	inches/hour
slow	0.06 to 0.2	inches/hour
moderately slow	0.2 to 0.6	inches/hour
moderate	0.6 to 2.0	inches/hour
moderately rapid	2.0 to 6.0	inches/hour
rapid	6.0 to 20	inches/hour
very rapid	>20	inches/hour

PERSISTENCE: As applied to chemicals, those which are very stable and remain in the environment in their original form for an extended period of time.

PESTICIDE: An agent used to destroy pests. Pesticides include such specialty groups as herbicides, fungicides, insecticides, etc.

pH: Negative logarithm of hydrogen ion concentration.

PL: Public Law.

POL: Petroleum, Oils and Lubricants.

POLLUTANT: Any introduced gas, liquid or solid that makes a resource unfit for a specific purpose.

POTENTIOMETRIC SURFACE: The imaginery surface to which water in an artesian aquifer would rise in tightly screened wells penetrating it.

ppb: Parts per billion by weight.

ppm: Parts per million by weight.

PRECIPITATION: Rainfall and snowfall.

PROPELLANT: fuels, oxiders and monopropellants.

QAE: Quality Assurance Evaluator.

RCRA: Resource Conservation and Recovery Act.

RECEPTORS: The potential impact group or resource for a waste contamination source.

RECHARGE AREA: A surface area in which surface water or precipitation percolates through the unsaturated zone and eventually reaches the zone of saturation. Recharge areas may be natural or manmade.

RECHARGE: The addition of water to the ground-water system by natural or artificial processes.

RECON: Reconnaissance.

RESISTIVITY: See Electrical Resistivity

RWDS: Radioactive Waste Disposal Site.

SAC: Strategic Air Command.

SANITARY LANDFILL: A land disposal site using an engineered method of disposing solid wastes on land in a way that minimizes environmental hazards.

SATURATED ZONE: That part of the earth's crust in which all voids are filled with water.

SAX'S TOXICITY: A rating method for evaluating the toxicity of chemical materials.

SCS: U.S. Department of Agriculture Soil Conservation Service.

SLUDGE: The solid residue resulting from a manufacturing or wastewater treatment process which also produces a liquid stream. The residue which accumulates in liquid fuel storage tanks.

SMS: Strategic Missile Wing

SOLID WASTE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).

SP: Spill area.

SPILL: Any unplanned release or discharge of a hazardous waste onto or into the air, land, or water.

SS: Supply Squadron.

STORAGE OF HAZARDOUS WASTE: Containment, either on a temporary basis or for a longer period, in such a manner as not to constitute disposal of such hazardous waste.

STP: Sewage Treatment Plant.

TAC: Tactical Air Command.

TACC: Tactical Air Control Center.

TASS: Tactical Air Support Squadron.

TCA: 1,1,1,-Tetrachloroethane.

TCE: Trichloroethylene, a solvent and suspected carcinogen.

TDS: Total Dissolved Solids.

TFTS: Tactical Fighter Training Squadron.

TFW: Tactical Fighter Wing.

TOC: Total Organic Carbon.

TOXICITY: The ability of a material to produce injury or disease upon exposure, ingestion, inhalation, or assimilation by a living organism.

TRANS: Transportation Squadron.

TRANSMISSIVITY: The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient.

TREATMENT OF HAZARDOUS WASTE: Any method, technique, or process including neutralization designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize the waste or so as to render the waste nonhazardous.

TSD: Treatment, storage or disposal sites/methods.

TTS: Technical Training Squadron.

TTW: Technical Training Wing.

UNCONSOLIDATED: Refers to a geologic material or soil unit composed of solid, discrete particles that are generally not cemented, bonded, intergrown through crystalline development, etc. Sand, gravel, clay or silt are typically taken to be terms assigned to unconsolidated materials.

UPGRADIENT: In the direction of increasing hydraulic static head; the direction opposite to the prevailing flow of ground-water.

US: United States.

USAF: United States Air Force.

USAFSS: United States Air Force Security Service.

USDA: United States Department of Agriculture.

USFWS: United States Fish and Wildlife Service.

USGS: United States Geological Survey.

USMC: United States Marine Corps.

USN: United States Navy.

WATER TABLE: Surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

WWTP: Wastewater Treatment Plant.

Zn: Chemical symbol for zinc.

APPENDIX J

REFERENCES

APPENDIX J
REFERENCES

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APPENDIX K

INDEX TO REFERENCE TO POTENTIAL CONTAMINATION SITES AT MCCONNELL AFB

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INDEX TO REFERENCE TO POTENTIAL CONTAMINATION

AT MCCONNELL AFB

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